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External shocks and the exchange rate regime: The case of ASEAN countries

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EXTERNAL SHOCKS AND THE EXCHANGE RATE REGIME: THE CASE OF ASEAN COUNTRIES

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ABSTRACT

ASEAN is a good representative example of regional economic cooperation and integration as well as among developing countries in general. ASEAN was established in 1967 and originally consisted of five members. However, this organization has subsequently achieved deeper and wider political and economic cooperation and expansion to 10 member countries.

Due to changes in the world economy, international economic interdependence and crises, ASEAN members initiated the ASEAN Economic Community (AEC) from December 2015, due to be completed by 2020, with the aim of transforming ASEAN into "a stable, prosperous, and highly competitive region with equitable economic development, and reduced poverty and socio-economic disparities" (ASEAN 2008). The attainment of the AEC in 2020 will represent a major landmark in terms of regional economic integration of ASEAN countries and for East Asia as a whole. The AEC has four objectives; achieving a single market and production base; becoming a highly competitive economic region; attaining equitable economic development; and becoming fully integrated into the world economy.

Achieving high trade openness and more integration to the global economy, however, makes ASEAN economies more vulnerable to external shocks. This may have negative impacts on economic stability and growth which then affect the income gap between and within ASEAN countries. This is because ASEAN member countries may respond differently to common external shocks. As a result, ASEAN may fail to achieve one of its stated pillars for success - equitable economic development in which not only the within-country but also between-countries income gap is narrowed.

In the literature the exchange rate regime is seen as an instrument that can minimise the negative effects of shocks on the stability of macroeconomic variables such as real output, the price level and the real exchange rate. Due to the impacts that these variables have on within-country and between-countries income gaps, the exchange rate regime may also play an important role in limiting the effects of these shocks on these income gaps. Yet this is a relationship that has not been investigated in the literature.

The purpose of this study is to investigate the effects and contribution of various types of shocks, namely a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock on key macroeconomic variables, namely real GDP, consumer price index (CPI), real exchange rate, within-country income and between-countries income gap under fixed and flexible exchange rate regimes for the ten ASEAN countries. By doing so, we can find out which exchange rate regime is better in dealing with the negative impacts of external shocks for ASEAN countries. In addition, this study aims to compare between the effects of external shocks on variables under each exchange rate regime to find out which type of shock affects and contributes most to the variables according to each exchange rate regime. Finally, this study attempts to recommend policies for ASEAN countries so that the negative impacts of external shocks on macroeconomic variables and the income gaps can be dealt with. This contributes to the attainments of the AEC.

To do so this study will construct a model for between-countries income gap which deals with the relationship between external shocks, real output, price level, real exchange rate and between-countries income gap. We also develop another model called the within-country income gap model, in order to investigate the relationship between external shocks, real output, price level, real exchange rate and the within-country income gap. To estimate these models, we employ annual data for ASEAN countries covering the period from 1999 to 2014 and the Structural Vector Autoregression (SVAR) approach.

In terms of the stabilities, we find that countries with a flexible exchange rate regime suffer more from external shocks than countries with a fixed exchange rate regime. In particular, in general, real output, real exchange rate and price level fluctuate more to external shocks under a flexible than under a fixed exchange rate regime. Furthermore, external shocks have more long-lasting effects on these variables under a flexible rather than under a fixed exchange rate regime. Moreover, external shocks have insignificant effects on variables in the long-run. The results of accumulated responses show more between-countries and within-country income equality under a flexible rather than under a fixed exchange rate regime exists in the case of a foreign demand shock. However, fixed regime is better than the flexible exchange rate regime in minimising the within-country and between-countries income inequality when a country is beset by a world real oil price shock.

In terms of accumulated effects, a flexible exchange rate regime is superior to a fixed exchange rate regime in absorbing a negative foreign demand shock and a positive foreign real interest rate shock because it generates higher economic growth and lower inflation. Nonetheless, a fixed exchange rate regime outweighs flexible exchange rate regime in coping with a positive world real oil price shock. This is because countries with a flexible exchange rate regime suffer more from a positive world real oil price shock with lower economic growth and higher inflation.

In general, we find that a foreign demand shock and a foreign real interest rate shock are main drivers of the volatility of economic growth. Additionally, a world real oil price shock plays the most important role in explaining the fluctuation of the price level and income gap under both exchange rate regimes. In addition, in terms of accumulated value, an increase in the world real oil price has negative impacts on ASEAN countries because it causes an output contraction, inflation, greater between-countries and within-country income gap.

This thesis makes a number of contributions to the literature. First, this is the first study considering between-countries and within-country income inequality in evaluating the superiority of the exchange rate regime with the presence of external shocks. Second, this is the first time that the *de facto* exchange rate regime classification by the IMF has been applied in investigating the effects and contributions of external shocks on the economy across exchange rate regimes. Third, this is the first time that a comparison has been attempted to explain the effects and contributions between external shocks under each exchange rate regime for ASEAN countries. Fourth, it is the first study to cover all ten ASEAN countries in investigating exchange rate regime superiority. Fifth, and finally, this study proposes policies that can best deal with external shocks to obtains the targets of the AEC such as macroeconomic growth, narrowing between-countries and within-country income gap.

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CERTIFICATION

I, Ngoc Hong Nguyen, hereby declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy in the School of Accounting, Economics and Finance, Faculty of Business, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This thesis has not been submitted for other qualifications at UOW or at any other academic institution.

Ngoc Hong Nguyen

27th March 2019

LIST OF ABBREVIATIONS

ABMI	ASEAN+3 Macroeconomic Research Office (AMRO) and the Asian Bond Market Initative
ACIA	ASEAN Comprehensive Investment Agreement
AEC	ASEAN Economic Community
AFAS	ASEAN Framework Agreement on Services
AFC	Asian Financial Crisis
AFTA	ASEAN Free Trade Area
AIC	ASEAN Industrial Complementation
AICO	ASEAN Industrial Cooperation
AIJVs	ASEAN Industrial Joint Ventures
AIPs	ASEAN Industrial Projects
APBSD	ASEAN Policy Blueprint for SME Development
APTA	ASEAN Preferential Trading Arrangement
ASA	Association of Southeast Asia
ASEAN5	Indonesia, the Philippines, Malaysia, Thailand and Singapore
ASEAN6	Brunei, Indonesia, Malaysia, the Philippines, Thailand and Singapore
BBC	Brand to Brand Complementation
CLMV	Cambodia, Laos, Myanmar and Vietnam
CMIM	Chiang Mai Initiative and its Multilateralization
EU	European Union
FAIA	Framework Agreement for an ASEAN Investment Area
FDI	Foreign Direct Investment
FTA	Free-Trade Agreement
GDP	Gross Domestic Product
GFC	Global Financial Crisis
IAI	Initiative for ASEAN Integration
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development

PDR	People's Democratic Republic
SMEs	Small and medium enterprises
SVAR	Structural Vector Autoregressive
TOT	Terms of trade
UNDP	The United Nations Development Programme

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CHAPTER 1: INTRODUCTION

1.1. RESEARCH BACKGROUND AND MOTIVATION

There are various types of income inequality such as income inequality between countries and within a country which is in the form of inequality between states, cities, provinces and groups of people. Income inequality has received widespread scholarly attention. Dabla-Norris *et al.* (2015) indicate that within-country income disparity is a major concern because it affects economic growth and stability. They also show that it can result in under-investment in education by lower income households. This affects certain growth drivers such as physical and human capital that lower labour productivity. Additionally, they point out that it can cause economic, financial and political instability which discourages investment and hence economic growth.

Institutions such as the World Bank increasingly emphasise income inequality, in that the attainment of sustainable economic growth relies fundamentally on equitable growth. Income inequality and especially the goal of addressing it within and between countries, is a key measure. It has also been of significant concern to the ASEAN economic community (AEC) which was established in 2015 with the aim of establishing closer regional economic integration. The AEC seeks to sustain economic growth, regional macroeconomic and financial stability, and for the region to be fully integrated into the regional and world economy. The need for inclusive growth is also highlighted, where the aim is to achieve equitable economic development. This means narrowing the development and income gap that exists both within and between the countries in ASEAN (Mordecai 2017).

Piotrowska (2008) indicates that regional economic integration and globalisation increase elements of growth such as the volume of international trade and foreign

investment from the rich countries to poor countries. This implies that the integration that the AEC is pursuing can play a key role in reducing the income gap between lower income countries and higher income countries in ASEAN. Nonetheless, ASEAN countries are high in trade openness which makes them highly vulnerable to external shocks potentially causing economic instability[1]. It has been widely regarded by the International Monetary Fund (IMF), the World Bank and highlighted in the United Nations Conference on Trade and Development (UNCTAD) that external shocks impinge negatively on the economic growth of developing countries and cause macroeconomic instability (Raddatz 2007).

More importantly, external shocks can lead to wider income gaps amongst ASEAN countries as well as the income gap within an ASEAN country, thus posing a serious threat to the success of the AEC in attaining one of its critical pillars for success - equitable economic development. A good example of this is where an external shock such as a decrease in foreign demand hits one ASEAN country, which then results in output volatility via its impact on the fluctuation of the real exchange rate. Consequently, output volatility affects economic growth, which then exerts an influence on the income gap within and between ASEAN countries[2].

As indicated in the World Economic and Social Survey of United Nations in 2006, the long-term growth performance of an economy is strongly affected by its macroeconomic stability. Therefore, while external shocks are considered as short-run macroeconomic shocks, they can destabilise economies, affect long-run growth rates and the within-country and between-countries income gaps via their impacts on macroeconomic instability.

[1] See Loayza and Raddatz (2007).
[2] Masron and Yusop (2008) find that with the existence of external shocks, ASEAN countries can have a larger income gap between them. In addition, the literature review in Chaper 3 shows that macroeconomic instability and economic growth have impacts on the within-country income gap.

There are several ways to reduce the within-income inequality such as a more equitable welfare program, redistribution of prosperity from the rich to the poor or tax policy. The income gap between the higher income and the lower income countries can also be reduced by policies that stimulate transferring money for migrant workers, favourable conditions for exports to higher income countries and foreign aid such as Official Development Assistance (ODA). However, these solutions do not always work well. A good example of this is the scenario where income redistribution or tax policy may lead to a reduction in the desire to work or even discourage the rich and entrepreneurs from working.

Therefore, in this study, we try to investigate another way via the choice of exchange rate regime, in order to minimise the negative impacts of external shocks on income inequality by achieving greater macroeconomic stability and economic growth. In theory, and in practice, the exchange rate regime is a channel to transmit the effects of shocks to macroeconomic variables which in turn impact on the between-countries and within-country income gap. This implies there is a possible link between shocks and the income gap via the exchange rate regime channel. However, this relationship has not been investigated in the literature. Therefore, this study aims to shed light on the possible links between external shocks and variables such as real GDP, CPI, real exchange rate, income gap within and between ASEAN countries under a fixed and a flexible exchange rate regime.

Specifically, this study expands the literature on the choice of the exchange rate regime by focusing on countries which are a part of an economic zone, specifically a free trade area. Unlike Chia *et al.* (2012) who include all ten ASEAN countries in a sample of 33 small open Asian countries, this study seeks to minimise the heterogeneity of the sample by focusing on only these ten nations which share a common objective in achieving

economic integration in the context of ASEAN and its policy priorities.

In addition, our study of the ten ASEAN countries casts light on issues of integration and policy coordination to attain the AEC's objectives, namely narrowing the income gap within and between ASEAN member countries and ensuring macroeconomic stability. This contributes to the success of ASEAN in the context of economic integration. Finally, this study makes a contribution to the issue of which exchange rate system is superior in not just limiting output, inflation and real exchange rate volatility to external shocks, but also presents a new dimension of their impact on income inequality.

1.2. RESEARCH OBJECTIVES AND QUESTIONS

The objective of this study is to investigate the optimal exchange rate regime, fixed or flexible, to minimise the negative effects of external shocks. In particular, this refers to the effects and contribution of a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock, on macroeconomic stability and the income gap (between-countries and within-country) for ASEAN countries under fixed and flexible exchange rate regimes. Furthermore, this study will highlight the shocks that have the greatest effect and contribution on key macroeconomic variables under each exchange rate regime. Finally, the last objective of this study is suggesting policy implications for the success of the AEC, namely dealing with external shocks, ensuring macroeconomic stability and reducing between-countries and within-country income gap. To obtain these objectives, this study answers the following research questions:

1. What are differences in responses of real output, the price level and real exchange rate to external shocks (including a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock) between a fixed and a flexible exchange rate regime?

2. What impacts do external shocks make on the between-countries income gap and within-country income gap under a fixed and a flexible exchange rate regime?

3. What are the similarities and differences between the effects of external shocks under a fixed and a flexible exchange rate regime?

4. Which exchange rate regime is superior in minimising the negative effects of external shocks?

5. Which is the dominant external source of the volatility of real output, the price level, real exchange rate, between-countries income gap and within-country income gap under a fixed and a flexible exchange rate regime?

1.3. METHODOLOGY

To achieve this study's research objectives, some analytical approaches are employed. Firstly, we use descriptive statistics to understand and to compare the fluctuations of variables, namely real GDP, CPI, real exchange rate, between-countries income gap and within-country income gap and external shocks, namely foreign demand shock, world real oil price shock and foreign real interest rate shock under fixed and flexible exchange rate regimes. Secondly, we review the literature to further understand the responses of macroeconomic variables to the shocks under different exchange rate regimes. We also review the relationship between variables to recognise the possible links between shocks, real output, price level, real exchange rate, between-countries and within-country income gap under fixed and flexible exchange rate regimes. Thirdly, and finally, this study uses a quantitative analytical approach, namely a structural model which is expressed as a panel vector autoregressive model (panel VAR), to conduct an empirical estimation and robustness test for model for between-countries income gap and model for within-country income gap, for ASEAN countries. The structure of panel VARs is the same as for the VAR model in which all variables are assumed to be endogenous and interdependent.

However, a cross sectional dimension has been added.

1.4. RESEARCH SCOPE

This study focuses on investigating and comparing the effects and the contribution of external shocks on the economies of ASEAN countries from 1999 to 2014. Although ASEAN was formed in 1967 the extension of ASEAN to include 10 member countries was completed by 1999. This is the year in which the IMF began to release its *de facto* exchange rate regime classification, which we adopt in this study. Accordingly, our sample period starts from 1999 and ends in 2014 as at the time we collected data, some data for Cambodia, Lao People's Democratic Republic (PDR), Myanmar and Vietnam are not available after this period. Variables for empirical analysis include shocks (foreign demand, world real oil price and foreign real interest rate), real GDP, CPI, real exchange rate, exchange rate regime, between-countries income gap and within-country income gap. These variables are collected from reliable sources, namely the International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), World Bank and United Nations Development Programme (UNDP).

1.5. THE STRUCTURE OF THE THESIS

This thesis contains eight chapters. This chapter provides the research background, motivation, research objectives, methodology and scope of the study.

Chapter 2 is concerned with the background of the ASEAN economy and its individual member countries. It also describes the process of global and regional cooperation and integration of the ASEAN grouping. Described here is the overall economic performance of ASEAN, including output, economic growth, consumer price index and real exchange rate. Moreover, this chapter provides information on the trade and financial linkages, income gaps between ASEAN countries and within each ASEAN

country. This chapter points out some challenges that ASEAN needs to address in order to achieve the targets of the AEC.

Chapter 3 reviews the literature on the importance of external shocks on ASEAN economies. This chapter also reviews the theoretical and empirical literature on the choice of the exchange rate regime which is based on a comparison of the impact of shocks on key macroeconomic variables under a fixed and flexible exchange rate regime. Moreover, this chapter reviews the optimal currency area literature which focuses on the suitability of fixing the nominal exchange rate between member countries participating in closer economic integration. The relationship between macroeconomic variables and the income gap (both between and within-country) is also reviewed in this chapter. Finally, from the literature review, this chapter highlights some research gaps.

Chapter 4 discusses two empirical models for the ASEAN countries. The first model-model for between-countries income gap considers the relationship between shocks, real output, the real exchange rate, the price level and between-countries income gap. The second model for within-country income gap focuses on the relationship between shocks, real output, the real exchange rate, the price level and the within-country income gap. To understand the nature of the data set this chapter reviews the data set employed in this study. Moreover, stability and co-integration tests are conducted in this chapter. In addition, this chapter presents the SVAR model and designs the contemporaneous matrix. This helps to determine the appropriate SVAR model for structural shocks identification through a recursive or non-recursive, and short-run versus long-run restrictions for the model for between-countries income gap and model of within-country income gap for ASEAN countries.

In Chapter 5 and Chapter 6, using SVAR and EVIEWS software, we conduct the

empirical analysis for the between-countries income gap and within-country income gap models, respectively. These chapters provide results for the impulse response function and variance decomposition under fixed and flexible exchange rate regimes. To ensure the robustness of the results we consider the change in the order of the variables in the contemporaneous matrix.

Based on the empirical findings discussed in Chapters 5 and 6, Chapter 7 outlines the recommendations on exchange rate policy and cooperation for the ASEAN countries. The goals are to achieve macroeconomic stability and narrow the between-countries and within-country income gap. Chapter 8 presents a summary, policy implication and recommendation, contribution and significance of the research. In addition, limitations of the thesis and some suggestions for future studies are presented in this chapter.

CHAPTER 2: ASEAN ECONOMY AND INTEGRATION

2.1. INTRODUCTION

ASEAN was formed in 1967 with five members, namely Indonesia, Malaysia, the Philippines, Singapore and Thailand with the aim of promoting regional political stability. However, this association only began to concentrate on economic targets and closer integration in the mid-1970s when concerns over regional political and security issues relating to the Cold War and combating the rise of Communism had been allayed. ASEAN subsequently became a more closely and expanded integrated region with a membership of 10 countries by the late 1990s. The 1990s marked the decade when the first efforts were made to establish agreements leading to regional economic integration. These agreements were as follows: ASEAN Industrial Projects (AIPs), the ASEAN Preferential Trading Arrangement (PTA), the ASEAN Industrial Complementation (AIC), the ASEAN Industrial Joint Ventures (AIJVs), Brand to Brand Complementation (BBC), ASEAN Free Trade Area (AFTA), and the ASEAN Framework Agreement on Services (AFAS). Today, ASEAN is considered to be one of the most successful intergovernmental organisations in the developing world, and provides a template for other developing countries wishing to engage in closer economic integration.

The ASEAN countries, especially the ASEAN6, were severely affected by the Asian Financial Crisis (AFC) in 1997-1998[3]. In the aftermath of the AFC, ASEAN realised that having a larger regional market would play an important role in attracting investors and in constructing more resilience to macro-financial stability (ASEAN & World Bank 2013). The first idea of forming AEC, with the aim of creating a "single market and production base", providing a sharp focus on regional and global economic and financial integration, was raised by Singapore's Prime Minister at the 8th ASEAN Summit in Phnom Penh, in

[3] The ASEAN6 consists of Indonesia, Malaysia, the Philippines, Singapore, Brunei and Thailand.

2002. Subsequently, the AEC was officially established in December, 2015 with the aim of creating a "single market and production base", and focusing on regional and global economic and financial integration.

The purpose of integration is to deepen the intra-ASEAN socio-economic relationship. In December 1997, ASEAN members agreed on a vision for ASEAN in 2020 that involved ASEAN becoming a "stable, prosperous, and highly competitive region with equitable economic development, and reduced poverty and socio-economic disparities". ASEAN countries signed the first AEC Blueprint with the aim of achieving an AEC with deeper economic integration, economic growth and development (ASEAN & World Bank 2013). These characteristics of an AEC are still targets of ASEAN Blueprint 2025. In addition, by launching the Initiative for ASEAN Integration (IAI), ASEAN sought to narrow the development gap between ASEAN member countries and between ASEAN and the world with the objective of achieve an equitable economic community.

The purpose of this chapter is to provide the context and background of ASEAN economies in the regional integration process. It also presents some challenges that may be obstacles to the success of the AEC. This chapter is divided into four sections: section 2.2 describes the process of global and regional cooperation and integration of ASEAN; and section 2.3 analyses ASEAN's recent macroeconomic performance. ASEAN's trade and financial linkages are reviewed in section 2.4. Key challenges facing ASEAN are discussed in section 2.5. Finally, major conclusions from this chapter are presented in section 2.6.

2.2. THE PROCESS OF GLOBAL AND REGIONAL COOPERATION AND INTEGRATION OF ASEAN

The Association of Southeast Asia (ASA) was formed in 1961, and included Thailand, Malaya and the Philippines with the aim of regional cooperation in economics,

societal, cultural, scientific and administrative fields[4]. This cooperation was short-lived due to a serious breakdown in bilateral relations between two of the key players, Malaysia and the Philippines (Caballero-Anthony 2005). There was also political and economic conflict between Malaysia and Singapore earlier in 1965. Singapore acrimoniously separated from Malaysia in August 1965. In 1966 Malaysia, Indonesia and the Philippines normalised their relationships. As a consequence, ASA initiated discussions to include more members and in May 1967, plans to enlarge ASA were replaced by a proposal to form a new grouping based on ASA's framework and be called ASEAN. The new grouping consisted of Thailand, Malaysia, Indonesia, the Philippines and Singapore. ASEAN was further expanded with the inclusion of Brunei (1984), Vietnam (1995), Laos (1997), Myanmar (1997) and Cambodia (1999).

In the ASEAN Declaration in 1967, also known as the Bangkok Declaration, ASEAN declared that it promoted economic progress and social and cultural development. At the beginning, plans were also put in place to liberalise trade among members in a bid to improve intraregional trade. However, it was not given a high priority and little progress was made for a long time because ASEAN mainly focused on political and security aims due to the rising influence of Communism in places such as Vietnam, Laos and Cambodia.

The leaders of the original five member countries conducted the first ASEAN Summit on the island of Bali in February 1976. The outcome was the Declaration of ASEAN Concord (or Bali Concord), with the stated aim of establishing a regional association of states as an anti-Communist block. This concord considered political cooperation as an important component. Although economic integration was also an initial driver for the cooperation of the primary five countries, it was ignored due to political instability at the time.

[4] ASA was the precursor of ASEAN.

When political tensions in the region began to ease during the mid-1970s, member countries began to turn their attention to closer and long-term cooperation (Chatterjee 1990). There were many initiatives for industrial and trade cooperation such as ASEAN Industrial Projects (AIPs) in 1976, the ASEAN Preferential Trading Arrangement (APTA) in 1977, which was an early effort to enhance intra-ASEAN trade via institutional integration and regional trade preferences (Chirathivat *et al.* 2015). Nonetheless, the achievements of these cooperation programs was limited because they lacked adequate preparation, commitment by member countries, financial and technical support and private-sector involvement, undeveloped mutual regional policy and slow administration (Areethamsirikul 2008; McGillivray & Carpenter 2013). Cuyvers *et al.* (2005) indicated that ASEAN nations in the 1970s were reluctant to open up their economies because of the development gap between them.

Moreover, the high economic growth achieved by ASEAN countries made them feel that it was not necessary to make efforts to liberalise trade any further. In particular, a number of the ASEAN economies (Thailand, Malaysia and Singapore) were later described as the East Asian miracle economies meaning that they grew very rapidly according to the World Bank in a 1993 report. A key reason for this was their engagement in international trade. However, this trade was mainly with the US, Europe, Japan, etc., but not with each other. The rise in intra-regional trade from the 1990s, which was associated with the rise in regional production networks, changed this to focus more on stimulating trade and investment flow in the region. ASEAN was the very hub for growth in the region's production network.

During the 1980s and 1990s, ASEAN further expanded its membership to include Brunei (1984), Vietnam (1995), Laos (1997), Myanmar (1997) and Cambodia (1999). Therefore, ASEAN now includes ten fast-growing countries that are at various stages of

economic and financial development (Almekinders *et al.* 2015). Than and Gates (2001) indicate some reasons for the enlargement of ASEAN. First, the original members of ASEAN recognised that such an expansion to include the whole of Southeast Asia would increase the diplomatic and economic weight of the association in the international community. Second, the enlargement of ASEAN would enable it to deal with regional issues more effectively. Third, the expansion would increase its population and market size by around 38 percent making it attractive to invest and sell its products in. Fourth, an expanded ASEAN would make it attractive to multinationals as a production base for participation in rapidly developing production networks in the region.

Naya and Plummer (1997) point out other reasons for the expansion of ASEAN. They indicate that the economic shocks experienced in the mid-1980s such as the collapse of oil prices pushed ASEAN countries to become outward-oriented, instead of inward-looking economies. Moreover, other developments then occurring in the world, such as more European integration, the competitiveness of developing countries such as China and the threat of protectionism of Western markets, the context of globalisation and the removal of economic barriers by most countries in the world, forced ASEAN to re-consider its role in easing trade openness and economic integration.

In 1992, ASEAN countries formed the ASEAN Free Trade Area (AFTA) at the Fourth ASEAN Summit. The purpose of AFTA was to enhance the competitiveness and economic efficiency of production of member countries (Kabir & Salim 2014). Economic cooperation was also conducted on trade in services. In 1995, the ASEAN Framework Agreement on Services (AFAS) was signed with the aim of removing all barriers on trade in services and liberalising trade in services according to the General Agreement on Trade in Services (GATS) (McGillivray & Carpenter 2013). Attracting foreign direct investment (FDI) has also been a strategy of outward-looking development of ASEAN. Hence, the

ASEAN Industrial Cooperation (AICO) Scheme was created in 1996 to offer more tariff and non-tariff incentives; the aim of AICO was to promote the inflow of investment into technology-based industries.

In the aftermath of the Asian Financial Crisis (AFC) in 1997/1998, which hit ASEAN's economy severely, ASEAN expanded financial cooperation and integration with the People's Republic of China, Japan and the Republic of Korea (ASEAN+3) through the Chiang Mai Initiative and its Multilateralization (CMIM), the ASEAN+3 Macroeconomic Research Office (AMRO) and the Asian Bond Market Initiative (ABMI) (ADBI 2016). This cooperation aimed to build up a network of currency swap and repurchase agreements, to ensure macroeconomic and financial stability through carrying out macroeconomic surveillance and supporting the implementation of a regional financial arrangement and to stimulate the development of a regional bond market.

At the Second ASEAN informal Summit, which was held in Kuala Lumpur in December 1997, ASEAN Leaders reaffirmed the commitment of the Bangkok Declaration on 8th August 1967, with the aim of motivating regional cooperation. At this Summit with a focus on the creation of the AEC, ASEAN leaders set out its "Vision 2020" in which ASEAN will be transformed into a stable, wealthy and competitive area with equitable economic development and reduced poverty and socio-economic disparities (ASEAN 2017c).

At the Ninth Bali Summit which was held in October 2003, ASEAN leaders signed the ASEAN Declaration (Bali Concord II) with the aim of establishing an ASEAN Community by 2020 with three pillars, namely the ASEAN Security community, the ASEAN Socio-Cultural Community and AEC. A few years later, at the ASEAN Economic Ministers Meeting, which took place in August 2006 in Kuala Lumpur, Malaysia and at the 12th ASEAN, Cebu, Philippines Summit in January 2007, ASEAN leaders signed the AEC

Blueprint and agreed to accelerate the establishment of the AEC by 2015 instead of 2020. According to ASEAN (2008), the AEC aimed to transform ASEAN into a region with "free movement of goods, services, investment, skilled labour and a freer flow of capital". The AEC Blueprint (2008-2015) in 2007 outlined a range of action measures and schedules for the attainment of the AEC (Chia 2013). Efforts to establish an AEC were also outlined in the Roadmap for AEC (2009-2015) which was agreed by ASEAN countries in Thailand in 2009[5].

The creation and acceleration of the AEC arose due to the following factors:

(1) The vulnerability of ASEAN countries to the AFC shocks in 1997 resulting from insufficient cooperation in dealing with global imbalances (Plummer & Chia 2009).

(2) ASEAN had many free trade agreements with dialog partners before or by 2015 and, hence, there was a need to create a comprehensive post-AFTA agenda (Guerrero 2008).

(3) Changes in the world economy required closer regional economic integration in ASEAN and, hence, such cooperation would assist ASEAN in keeping pace in terms of growth, development, competitiveness and attractiveness to foreign investors to locate their production in the region given the emergence of countries such as China, India, the Republic of Korea and others (Ravenhill 2008; Chia 2013; Chirathivat *et al.* 2015; ADBI 2016).

(4) ASEAN realised the importance of regional integration to attain political and social stability and sustainable growth (Plummer & Chia 2009) as well as to offset the growing regional political and economic influence of China.

ASEAN (2008) has pointed out four pillars that AEC aims to achieve. The details of these pillars are summarised below.

[5] See Table A1 in Appendix A for a summary of regional cooperation.

i. Single market.

The AEC aims to transform ASEAN into a single market and production base with major elements such as the free flow of goods, services, investment, and skilled labour and freer capital movement. ASEAN firms will also benefit from economies of scale and efficiency in production networks due to the single market and production base. In addition, intra-regional trade and investment flows will increase due to the integrated market and production base (Chia 2013).

ii. Competitive economic region

ASEAN aims to become a competitive economic region with common policies on competition, consumer protection, intellectual properties right and the development of infrastructure. Becoming a competitive economic region is an important part of the AEC because it is fundamental to the achievement of the other targeted characteristics of the AEC. In particular, it helps ASEAN attain equitable economic development and to fully integrate with the world economy. Economic competitiveness and global economic integration require member countries to be globally competitive. The aim of competition policy is to promote fair competition among all businesses, large and small, state and privately owned, domestic and foreign owned. Hence, competition plays a key role in distributing fairly the benefits from regional integration among member countries as well as between consumers and manufacturers.

iii. Equitable development

The discrepancies in development that are evident within and between the ASEAN countries is one of the biggest challenges in forming the AEC. With this in mind, ASEAN set up a third pillar known as equitable economic development, in which ASEAN countries affirm that the poverty and development gap between member countries will be reduced by mutual support and cooperation (ASEAN 2012). Equitable economic development

includes two core elements: firstly, the development of small and medium enterprises (Imran Sharif *et al.*); and, secondly, the Initiative for ASEAN Integration (IAI) (Chia 2013). In terms of the IAI, the entry of new members during the 1990s raised concerns about the development gap between the old and new members. This development gap includes not only the difference in the average per capita income but also differences in human resources, infrastructure, institutional capacity and level of competitiveness. To address this concern a program aimed at narrowing the development gap among ASEAN members and between ASEAN and the rest of the world, called the Initiative for ASEAN integration, was adopted by ASEAN countries.

To deal with the development gap and promote the economic integration of less developed countries in ASEAN, the deepening and broadening of integration in ASEAN countries was to be accompanied by cooperation in technology and development. As a result the benefits of economic integration were to be shared by every member country. At present, some priority fields are considered in the IAI, including infrastructure, human-resource development, energy, tourism, poverty reduction, life quality improvement. To cope with the challenges of AEC such as closing the development gap or catching up with the higher income countries such as the ASEAN6, lower income ASEAN countries such as Cambodia, Laos, Myanmar and Vietnam (CLMV) should develop policies to boost economic growth, and enhance economic competitiveness, and increase domestic and foreign investment.

iv. Integration into the global economy

To be fully integrated into the world economy, ASEAN aims to strengthen the trade and investment relationship it has with the rest of the world and become a more dynamic and stronger part of the global supply chain. ASEAN will also create opportunities for investors to access ASEAN markets and other ASEAN trade partners (USA, China, Japan

and India) and Free-Trade Agreement (FTA) partners (South Korea, Australia and New Zealand).

2.3. OVERVIEW OF THE ASEAN ECONOMY

2.3.1. Output and economic growth

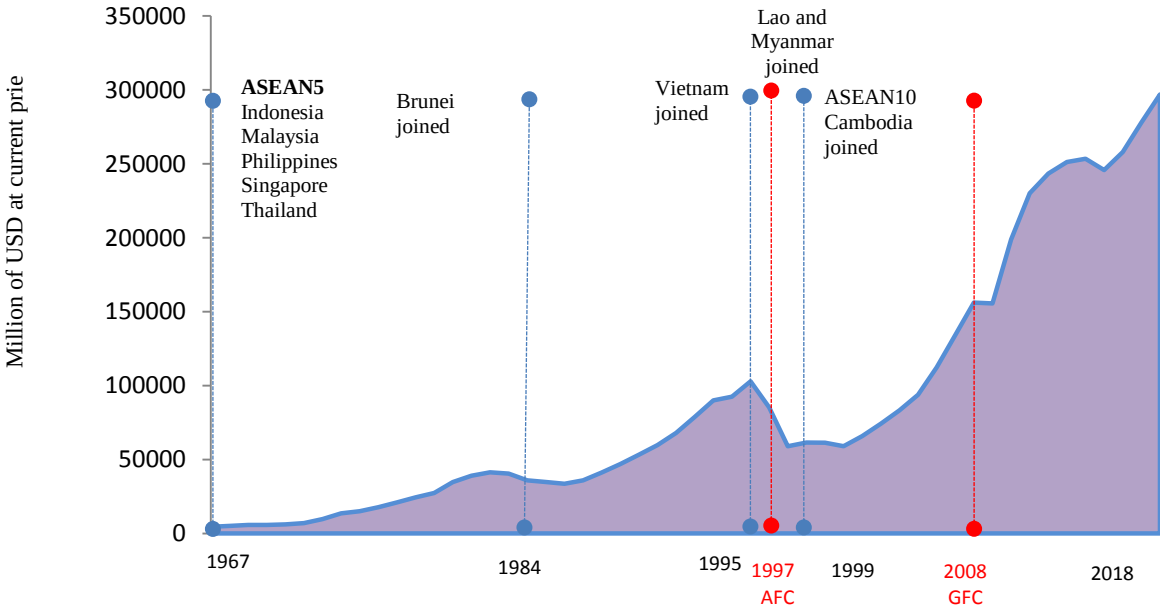


Figure 2.1: Evolution of ASEAN's GDP

Source: UNCTAD and ASEAN (2017b)

ASEAN's economy has achieved remarkable development in terms of output and economic growth. In fact the ASEAN economy has increased more than 100-fold since 1967, reaching a nominal GDP of about US$0.3 trillion in 2018. The total GDP of ASEAN in 2016 was the 6th and 3rd largest in the world and Asia, respectively. Additionally, the contribution of ASEAN's GDP to world GDP on a PPP basis has nearly 17 times from 0.2% in 1967 to 3.5% in 2018 (see Figure 2.2). ASEAN has generally experienced stable and positive economic growth, except in 1998 when it was -7.82% due to the damaging outcomes of the AFC (see Figure 2.2).

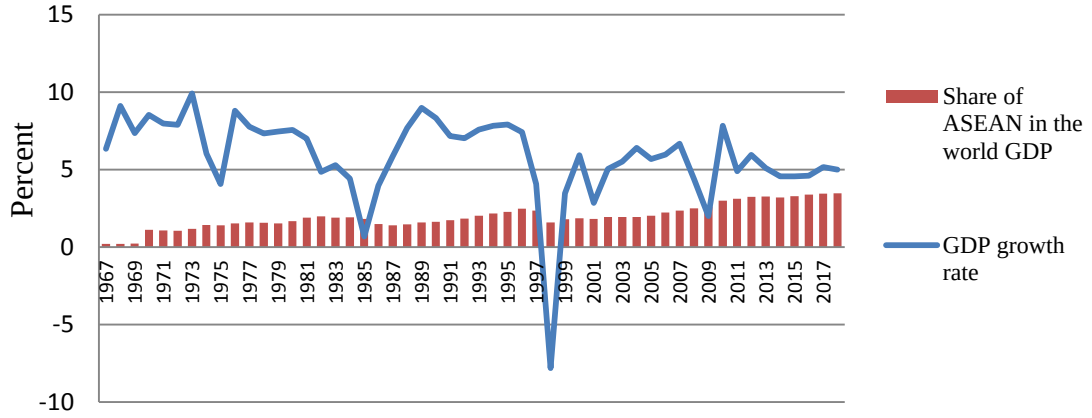


Figure 2.2: ASEAN Economic growth and its share of world nominal GDP

Source: Author's calculation; UNCTAD for share of ASEAN in the world GDP; Worldbank for GDP growth rate

Table 2.1 illustrates real GDP growth in ASEAN. It can be seen that the poorer member countries have faster real GDP growth than the more developed member countries. In particular, the CLMV countries have had annual real GDP growth at about 6-7% whereas that of Brunei and Singapore is just 2-3% for the period 2016-2017.

Table 2.1: Real GDP growth in ASEAN countries (annual percentage change)

	1999-2015	2016	2017
ASEAN 6			
Indonesia	5.14	5.03	5.07
Malaysia	5.15	4.22	5.90
Philippines	4.99	6.88	6.68
Thailand	4.08	3.47	4.09
Brunei	1.14	-2.47	1.33
Singapore	5.63	2.40	3.62
CLMV			
Cambodia	8.07	6.95	6.85
Lao PDR	7.12	7.02	6.89
Myanmar	9.68	5.89	6.84
Vietnam	6.43	6.21	6.81

Source: Author's calculation from data of IFS, IMF (http://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B&sId=1390030341854)

In 1997 the AFC started when Thailand announced abandonment of the fixed exchange rate of the baht to the US dollar, due to insufficient foreign reserves to maintain a

fixed exchange rate regime. The crisis had a severe contagion effect on the currencies of some other ASEAN member countries, namely Malaysia, Indonesia, the Philippines and Singapore. Ito and Sato (2008) state that in comparison to other ASEAN countries, the Indonesian economy, in particular, suffered most from the AFC and required more time to recover.

Figure 2.3 shows the annual average real GDP growth rate of the ASEAN6 and the CLMV. It can be seen from this figure that the AFC exerted the most severe impact on the economic growth of the ASEAN6. The economic performance of the CLMV was also impacted by external shocks originating from the region because these countries depended on the regional export market, but this impact was much less than that for the ASEAN6. Therefore, trade and foreign direct investment with the Asian crisis-afflicted countries were the two major channels through which the AFC affected the CLMV. However, the CLMV countries were still not well integrated with the ASEAN6 at this time and, consequently the impacts were quite small. Cambodia not only suffered from the external shocks but was also affected by domestic political uncertainty arising from the overthrow of the First Prime Minister, Prince Norodom Rannaridh (Okonjo-Iweala *et al.* 1999).

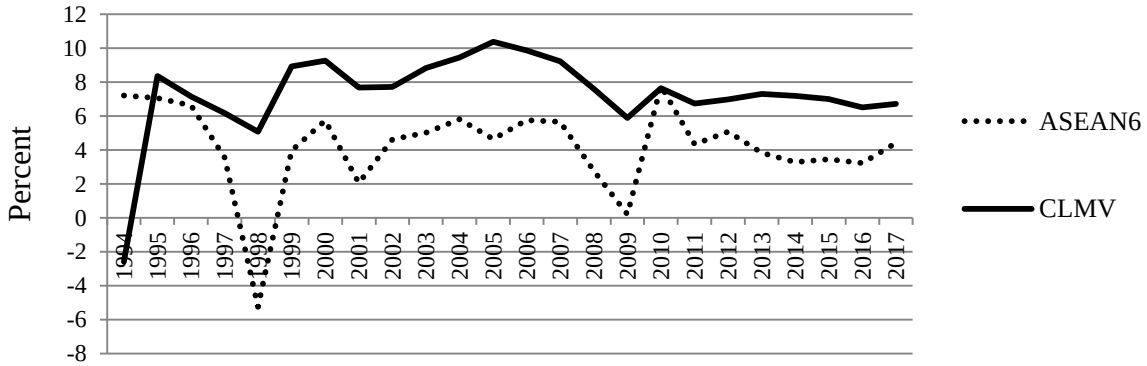


Figure 2.3: Annual GDP growth, 1994-2017

Source: Author's calculation from Wold Development Indicators_World Bank (https://databank. worldbank.org/data/reports.aspx?source=2&series=NY.GDP.MKTP.KD.ZG&country=)

The crisis had less of an impact on the CLMV than the ASEAN6 for a number of

reasons, such as the CLMV had non-convertible currencies, limited dependence on the world economy, the absence of stock market and portfolio investment, a weak reliance of domestic enterprises on the banking system and a protected capital account. Therefore, investment and growth had fewer risks coming from potential capital outflows. Hence, the influence of the crisis on the CLMV mainly resulted from the export and FDI channels. In addition, these countries were not fully integrated into the world economy, and so they were less affected by external shocks.

The ASEAN6 economy recovered quickly post-AFC because of the escalation in global demand for their exports that came from the dramatic currency depreciations and the robustness of global external demand. In addition, the rebound in exports resulted from more flexible exchange rate regimes post-AFC which improved export competitiveness.

In 2001, the global economic downturn became unfavourable for ASEAN. Hew (2002) highlighted that the terrorist attacks in the United States on 11 September 2001 affected consumers' confidence and this resulted in the contraction of the U.S. economy. In addition, economic recessions in Japan and the EU, which were come from the dot-com bubble crash, deteriorated the global demand for ASEAN's exports which then dampened their economic growth[6]. The economic growth of the ASEAN6 declined from about 6% in 2000 to just 2% in 2001. There was also a mild decline in the economic growth of the CLMV countries (see Figure 2.3). Hew (2002) also indicates that the global downturn had the worst effects on Singapore and Malaysia because these countries are small open and export-intensive economies, particularly of semiconductors and electronics. Indonesia, the Philippines and Thailand were also negatively affected by the economic slowdown. The low level of dependence on external trade meant that the CLMV was actually less affected

[6] This period was described as the dot-com bubble crash where a major decline in the price of semiconductors led to a decline and then crash of high tech companies. A number of ASEAN countries were major producers of semi-conductors.

by the disadvantageous global economic environment. However, the decline in intra-regional trade and investment did affect their economies.

In 2008 the effects of the global financial crisis, which originated in developed economies, endangered the growth of ASEAN countries. The severe recession led to a steep decline in global trade. This reduced the demand for ASEAN's goods and services, resulting in a collapse in exports and an economic downturn because exports are a main driver of growth for member countries. Singapore, Malaysia and Thailand were again the most affected because their industries are sensitive to the global business cycle, and their exports are mainly electrical machinery and automobiles (OECD 2010) with major markets in the United States of America (US) and European Union (EU).

ASEAN's economy recovered quickly in the years following the crisis. A good example is that the real GDP growth rate of ASEAN increased sharply from about 2% in 2009 to nearly 8% in 2010 (see Figure 2.3). The resilience of the ASEAN economy arises from the growth and resilience of domestic markets and effective monetary and fiscal policy responses, such as fiscal and monetary stimulus packages, to GFC shocks (Jeasakul *et al.* 2014) . In addition, limited financial integration and capital flow restrictions in place in ASEAN capital markets meant that is was less affected and exposed to the financial meltdowns in the US, EU and other major financial markets. Consequently, the GDP growth of Singapore, Malaysia and Thailand recovered noticeably. The Philippines, Indonesia and the CLMV economies also exhibited resilience in 2010. The recovery of these economies was due to growth in domestic and foreign demand, a surge in remittances and an improvement in business and consumer confidence.

Compared to the AFC, ASEAN's economy was less damaged by the GFC and recovered quicker. The reason is that in the post-AFC period the establishment and further development of regional trade networks made the intra-ASEAN international trade

relationship become more closely knitted and robust. As a result, this has made ASEAN become more resilient to shocks.

2.3.2. Inflation

The AFC had a severe impact on the inflation rate in some ASEAN member countries such as Indonesia, Lao PDR and Myanmar with a 58%, 90% and 49% annual inflation rate in 1998, respectively. In 1999, Lao PDR's inflation was 128%[7]. Ito and Sato (2008) showed that the sharp depreciation of the Indonesian rupiah led to high inflation so that the change in the real exchange rate was not enough to promote exports. The inflation rate for Lao PDR was the most vulnerable to the external shocks coming from the AFC. Thayer (2000) explains that Laos's trade was heavily dependent on that with Thailand, and that this bilateral trade was mainly valued in US dollars or Thai Baht. Therefore, the Lao Kip lost its value to the USD when the Baht depreciated because the latter was the main element of the Lao money supply. Hence, the increased price of imported goods caused hyperinflation in Lao PDR in 1999.

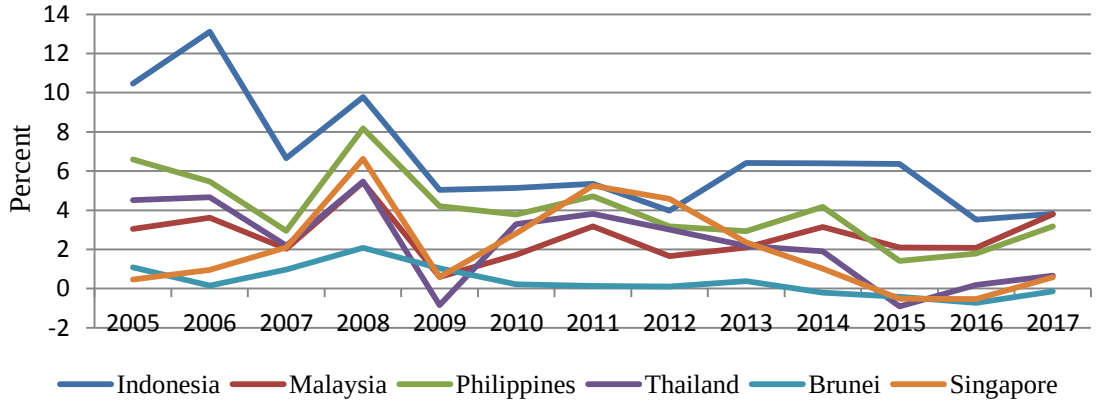
After the AFC, inflation has been managed better. To deal with high inflation, policy-makers applied many treatments such as interest rate hikes (Thailand, Indonesia and Philippines) as well as credit tightening (Cambodia, Lao PDR and Vietnam) (Rillo 2009). Moreover, inflation targeting and adopting more floating exchange rate regimes were applied. Consequently, interest rate and inflation fluctuations decreased (Dungey & Vehbi 2015).

Figures 2.4 illustrates the inflation rates of the ten AEAN countries between 2005 and 2017. In general, the inflation rates of the ASEAN countries prior to the GFC were moderate. However, the inflation rate of the ASEAN6 increased sharply during the crisis.

[7] See Table A2 in Appendix A

This was mainly due to the rise in the prices of oil and other commodity prices (OECD 2010). Vietnam, Myanmar and Cambodia experienced much more serious inflation during the GFC. For example, the inflation rates of Vietnam and Cambodia were 23% and 25% in 2008, respectively. Additionally, Myanmar had an inflation rate of 31% in 2006[8]. The rapid increase in the inflation rate of all these countries resulted from prior accelerated credit expansion (OECD 2010).

a. ASEAN6 countries



b. CLMV countries

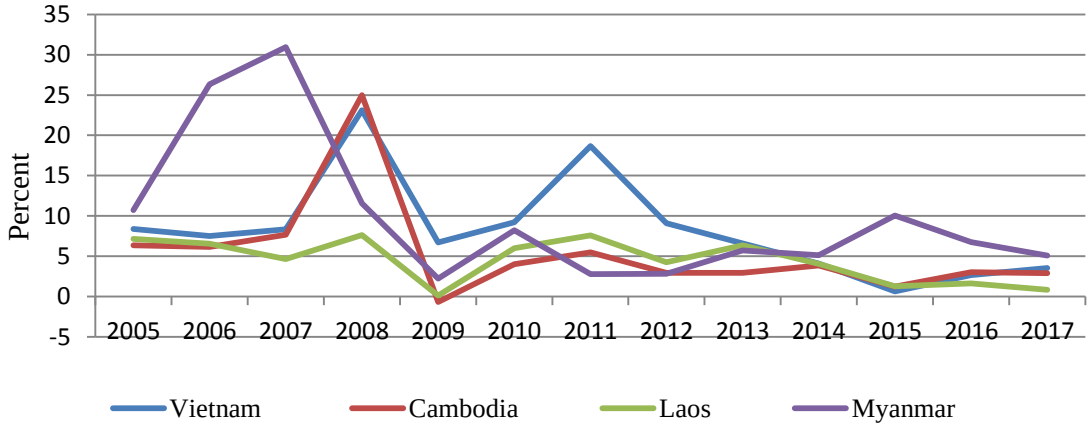


Figure 2.4: CPI inflation, 2005-2017

Source: World Economic Outlook (https://www.imf.org/external/pubs/ft/weo/2018/02/weodata/index .aspx)

[8] See Table A2 in Appendix A

2.3.3. Interest rate

According to ASEAN (2019), the prospects of the Japanese economy in early May 1997 resulted in a dramatic increase in JPY and Japanese short-term interest rate. As a consequence, investors withdrew their funds from ASEAN countries to invest in Japan to get higher profits from higher interest rates in Japan. This affected the foreign reserves and led to vulnerability of the Thai baht. Some ASEAN countries raised interest rates to support their domestic currencies and to prevent capital outflows. A good example is that the discount rate of Indonesia hit 70 percent in July, 1998 while the policy interest rate in Thailand hit double digits in 1998 (Goldstein & Xie 2009). However, the Bank of Thailand could not prevent the baht from devaluing because of losing all foreign reserves. Consequently, Thailand had to float its currency on 2 July 1997 and this caused the contagion effect on other countries such as Philippines, Malaysia and Indonesia.

It can be seen that a fixed exchange rate regime with domestic interest rate which was higher than the international interest rate led to the inflow of long-term and short-term investments. This caused risks on short-term foreign indebtedness if there was a capital withdrawal. Furthermore, higher interest rates resulted in difficulties for companies in attaining funds for investment and trade financing, which limited activities in the manufacturing industry.

Unlike the AFC, monetary and financial systems of ASEAN countries were more resilient in the global financial crisis in 2008. The GFC affected ASEAN countries via certain channels such as the drying up of trade credit and the inflow of capital, the withdrawal of global banks, heightened risk aversion and a sharp decrease in asset values. However, there was no severe impact on financial markets; in particular, interest rates stayed stable in most countries. There were some reasons that contributed to the resilience of ASEAN to the GFC, including the absence of credit excesses and currency mismatches

and strong balance sheets of households and corporations which played a role in sustaining confidence. In addition, the appropriate responses of monetary policy such as cutting interest rate in the recession, monetary stimulus such as interest rate subsidies and decisive macroeconomic policy played a role in restoring the confidence, accelerating bank credit growth, supporting domestic demand and preventing layoff in the labour market (Keat 2009).

2.3.4. The exchange rate and exchange rate regime

Achsani *et al.* (2010) show that exchange rate regime plays a crucial role in minimising the risks coming from volatility of exchange rate by which the economy is affected. They example that although ASEAN experienced high economic growth before the AFC, the decision to float the Thai Baht in mid-1997 caused a sharp depreciation of the currency and brought about contagion effects to other ASEAN country currencies in Malaysia, Thailand, the Philippines and Indonesia[9]. The fixed exchange rate regimes in these countries set an unrealistically high value of the domestic exchange rate relative to the USD and made them vulnerable to the AFC, because foreign reserves were not large enough to cope with the currency speculation and meet the repayment of interest on short-term foreign debt mostly denominated in USD.

Caporale *et al.* (2018) show that in the past, most ASEAN member countries' currencies were tightly linked to the US dollar. Even in the period 1999-2003 after the AFC, although the exchange rate regime of many Asian countries has become more flexible, the US dollar remained the dominant anchoring currency. Nonetheless, Caporale *et al.* (2018) point out that the role of the US dollar as an anchoring currency becomes less important due to the importance of China's currency. They explain that this is caused by

[9] The decision to float the Baht was made because Thailand had a lack of foreign exchange reserves to maintain the pegged exchange rate regime to the US dollar.

the greater trade and investment relationship between China and ASEAN.[10] In addition, the importance of China's currency to ASEAN has resulted from the devaluation of China's currency which creates competitiveness for China in exporting to Western countries and in attracting FDI.

The exchange rate regimes of ASEAN countries have changed remarkably since the AFC. Before the AFC these countries fixed their exchange rates to the US dollar with the aim of keeping inflation low and stimulating export competitiveness and capital inflows, particularly for the cases of Thailand and Indonesia. However, after the AFC and collapse of the fixed exchange rate regimes, most Asian countries adopted relatively flexible exchange rate regimes (Wiboonchutikula *et al.* 2015). A more flexible exchange rate regime played an important role in reducing pressure on the exchange rate adjustment during the Global Financial Crisis (GFC) (Park *et al.* 2013)[11]. In addition, the movement to a more flexible exchange rate regime played an important role in increasing the autonomy of monetary policy for ASEAN countries and keeping inflation low. However, these exchange rates were in reality less flexible than official announcements (OECD 2010).

The IMF (2016) reported changes in the exchange rate regime of the ASEAN5 which are summarised in Table 2.2[12].

[10] The ASEAN-China FTA was signed in November 2002 and trade has grown rapidly since then, reaching about US$350 billion in 2015. More recently this has included FDI flows from China to ASEAN (mainly to Cambodia, Laos and Myanmar).

[11] This was because ASEAN countries did not need to use their foreign exchange reserves to maintain a fixed regime.

[12] Indonesia, the Philippines, Malaysia, Thailand and Singapore.

Table 2.2: Evolution of the exchange rate regimes of the ASEAN5 countries

Countries	Changes in exchange rate regime
Indonesia	Before the AFC, Indonesia applied a crawling pegged exchange rate regime and an open capital account. However, since the AFC the exchange rate regime of Indonesia has become more flexible and, hence, monetary policy is more independent.
Philippines	The Philippines applied a managed exchange rate and a relatively closed capital account. After the AFC the Philippines continued to apply a pegged exchange rate regime but freer capital account and a less independent monetary policy. Since the GFC, it has a more flexible exchange rate regime and a more independent monetary policy.
Malaysia	A managed exchange rate regime and an open capital account were applied before the AFC. However, in the aftermath of the AFC Malaysia adopted a fixed exchange rate regime but a more closed capital account (or capital controls). During and after the GFC a more flexible exchange rate regime with a liberalised capital account and more independence monetary policy has been implemented in Malaysia.
Thailand	A managed exchange rate, open capital account and dependent monetary policy had been applied in Thailand before the AFC. However, after the AFC, Thailand has moved to a more flexible exchange rate regime with a closed capital account and interest rate autonomy. Since the GFC the exchange rate regime of Thailand is now more flexible and the country has adopted a more independent monetary policy.
Singapore	There has been no change in policies. It still has an open capital account, a managed floating exchange rate regime and market determined interest rate[13].

Source: IMF (2016)

[13] A managed floating regime allowed the Singapore dollar to vary within an undisclosed band and this helped to reduce currency speculation (Li 2012)

Vietnam has also experienced reform of its exchange rate regime. After 1991 Vietnam applied a fixed regime with a horizontal band aimed at managing inflation and stabilising the economy[14]. During the AFC the Vietnamese Dong lost its value, being indirectly affected via a decline in exports and FDI inflow. The state bank of Vietnam widened the trading band from 1 to 10 percent in October 1997 (Phuc & Duc-Tho 2009). During the GFC Vietnam was faced with an economic downturn with a high inflation rate and a depreciation of the currency. Since then, Vietnam has adopted a more flexible exchange rate regime to ease the pressure of devaluation of the Vietnam Dong (Hung & An 2011).

According to Menon (2013), Cambodia has the highest level of dollarization, followed by Lao PDR and Vietnam whilst a multiple currency system is implemented in Myanmar[15]. Further, the nominal exchange rates of the CLMV did not respond quickly to shocks emanating from the AFC because of dollarization and a multiple currency system and, hence, changes in the real exchange rate were mainly caused by changes in the price level rather than from fluctuation of the nominal exchange rate. Okonjo-Iweala *et al.* (1999) contend that compared to other ASEAN countries, the Cambodian Riel lost its value less dramatically due to extensive dollarization. However, volatility of the Lao Kip was more vulnerable to the exchange rate shocks during the AFC because of the very close link to the Thai Baht[16].

Figure 2.5 and Figure 2.6 present the annual changes in nominal exchange rate of ASEAN countries (except Myanmar). In general, the movements of exchange rate of ASEAN countries display similar patterns. In particular, in 2001, the exchange rate

[14] See Table C2 in Appendix C for the definition of a fixed exchange rate regime with a horizontal band.
[15] Dollarization is the use of a foreign currency as a medium for transactions and as a store of value (Menon 2007).
[16] Both the US dollar and Thai baht are used widely in Lao PDR.

depreciated due to September 11 attacks. In 2007, most currencies of ASEAN countries appreciated because of concerns for a recession in the U.S., stemming from the weakness in US housing price, unemployment as well as fears on US banks' and fund's exposures to the sub-prime mortgage market. In 2009, ASEAN countries's currencies depreciated due to the influence of global financial turmoil. However, ASEAN countries' currencies appreciated the following year because of the resilience of the domestic economy and the acceleration of capital inflows which came from the stronger economic growth in emerging market countries relative to that of developed countries. Furthermore, investors' optimistic view on the recovery of the U.S economy, the tension within Korean peninsula, the tight monetary policy of China and the public debt problem in Ireland all contributed to an appreciation in the ASEAN currencies (Pilipinas 2007; Pilipinas 2009; Thailand 2010).

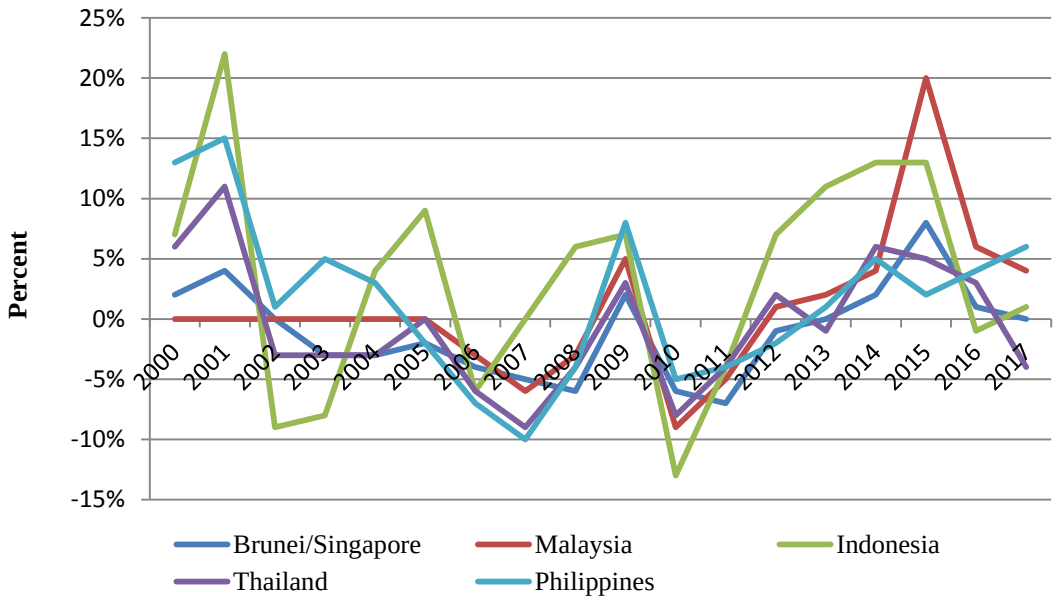


Figure 2.5: Annual changes in nominal exchange rate of ASEAN6

Source: Author's calculation from nominal exchange rates data of IFS, IMF

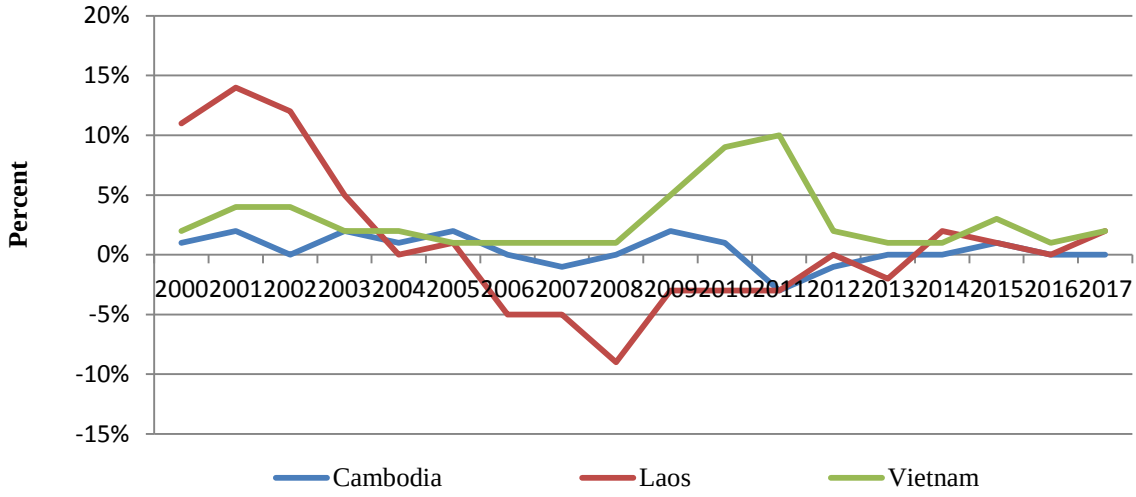


Figure 2.6: Annual changes in nominal exchange rate of CLV

Source: Author's calculation from data of IFS, IMF

Table 2.3 illustrates the annual change in nominal exchange rate of Myanmar. The currency of Myanmar was fixed with foreign currencies before the managed float exchange rate regime in April, 2012. Prior to this exchange rate regime, multiple exchange rates were applied in Myanmar; there was the official rate which was for the public sector, the trade rate which was for international trade and the unofficial rate which was for the private sector. Myanmar's currency was 40% overvalued relative to U.S dollar and the market rate stood at high rate with 800-1000 Kyats per U.S. dollar before the unification of exchange rate on 1st, April 2012 (Min & Khoon 2014).

Table 2.3: Annual changes in nominal exchange rate of Myanmar (%)

Year	Percentage	Year	Percentage
2000	+4%	2011	-3%
2001	+4%	2012	+11,680%
2002	-2%	2013	+46%
2003	-8%	2014	+5%
2004	-6%	2015	+18%
2005	0%	2016	+6%
2006	0%	2017	+10%
2007	-4%		
2008	-3%		
2009	+3%		
2010	+1%		

Source: Author's calculation from data of IFS, IMF

2.3.5. Development gap

As indicated in Section 2.2, reducing the development gap between ASEAN countries is the major concern. Therefore, this section aims to shed light on the development gap between ASEAN countries as well as between the old (ASEAN6) and the new members (CLMV) on three perspectives: the income gap, human development gap and digital gap.

2.3.5.1. Income per capita and the income gap

Figure 2.7 illustrates the average income per capita of ASEAN over the period 1967 to 2016. It can be seen that the movement of GDP per capita followed the trend in the growth of GDP. ASEAN's GDP per capita rose strongly from just US$274 in 1967 to US$12,968 in 2018. However, income per capita decreased sharply during the 1997-98 AFC but only slightly during the 2008 GFC. The ASEAN countries fared better and were more resilient during the GFC because they quickly implemented fiscal and monetary stimuli. The financial and structural reforms after the AFC resulted in fewer financial and external vulnerabilities, and the movement to a more flexible exchange rate regime served as 'shock absorbers' and encouraged and maintained closer international trade (Jeasakul *et al.* 2014; Beng *et al.* 2015).

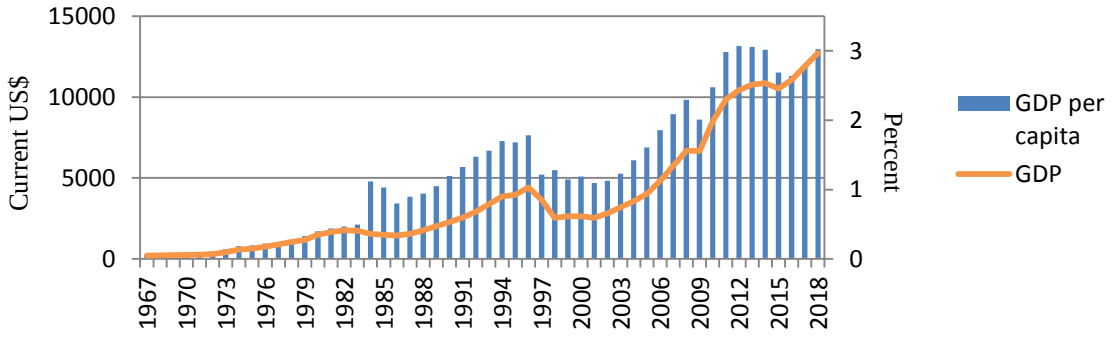


Figure 2.7: GDP and GDP per capita of ASEAN at current price

Note: The numbers in blue are measured on the left axis while the numbers in orange are measured on the right axis.

Source: Author's calculation from World Development Indication, World bank (https://databank.worldbank.org/source/world-development-indicators)

Figure 2.8 demonstrates the average income per capita, PPP of ASEAN. It can be seen that ASEAN countries have significantly improved in terms of per capita income. However, the income gap between them becomes greater. The income per capita of Singapore and Brunei are the most significant, followed by Malaysia and Thailand. Singapore and Brunei are in the world's top five countries with the highest GDP per capita. The World Bank has classified countries into four income groups according to GNI per capita: namely, low-income countries (those with $995 or less), lower-middle income countries (those with $996 to $3895), upper-middle income countries (those with $3896 to $12055) and high income countries (those with $12056 or more). According to this classification, ASEAN lower-middle income countries include Cambodia, Lao PDR, Myanmar, Vietnam, the Philippines and Indonesia. Thailand and Malaysia are classified as upper-middle income countries. Brunei and Singapore are listed as high-income countries (Worldbank 2018, September 18).

Higher income per capita helps some ASEAN countries attain higher income status. For example, Cambodia was reclassified from a low-income country to a lower-middle income country in 2015. Moreover, Lao PDR and Myanmar were also re-classified as low middle-income countries in 2011 and 2015, respectively. Furthermore, Thailand and Malaysia have been upgraded to upper-middle income countries since 2011 and 2017, respectively.

There are two types of income inequality throughout ASEAN. The first type is income disparity between member countries, which reflects the gap in the level of economic development. It can be measured by the difference in per capita income. The second type is income inequality within the individual member country, which is measured by the Gini coefficient. In terms of the first type, although all ASEAN countries have improved per capita income, the income gap between them remains relatively large. For

example, in 2016 Singapore had five times the income per capita compared to Malaysia whereas Malaysia's is four times the income per capita of the Philippines. The latter country's income per capita is more than double that of the CLMV. The income gap also occurs between countries in each group of the high-income countries, the lower-middle income countries, upper-middle income countries, ASEAN6 and CLMV.

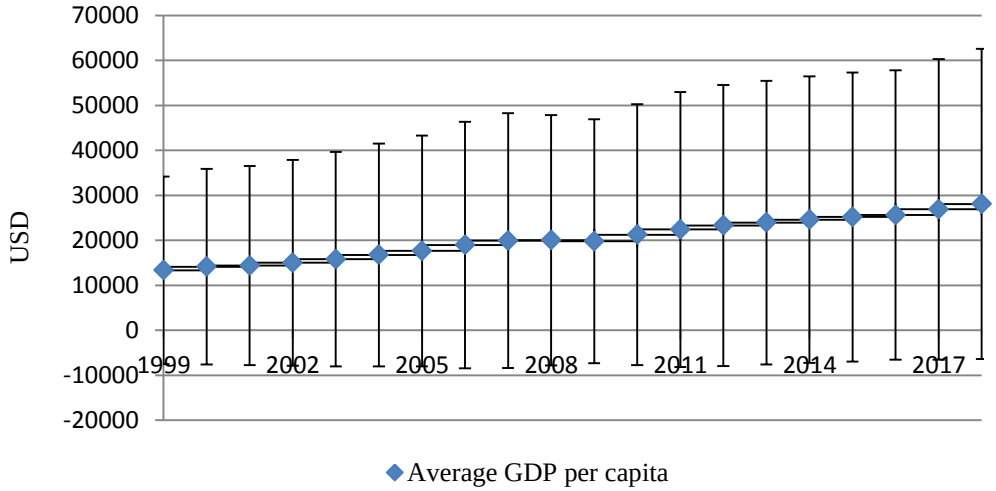


Figure 2.8: Average GDP per capita, PPP of ASEAN countries and standard deviation (1999-2018)[17]

Source: Author's calculation from data of World Bank (https://databank.worldbank.org/ reports. aspx?source=2&series=NY.GDP.PCAP.PP.CD&country=)

In addition, Figure 2.9 shows the income gap between the old member countries group (ASEAN6) and the new member countries group (CLMV). [18]. This income gap was already quite large in absolute terms in 1999 and widened further by 2016. In relative terms there has been an improvement in income per capita for CLMV countries. In particular, average CLMV income per capita was one-fifth that of the ASEAN6 in 1999 declining to one-third in 2018.

[17] The standard deviation shows the dispersion in GDP per capita between the members and the mean value.
[18] ASEAN6 includes Brunei, Singapore, the Philippines, Thailand, Indonesia and Malaysia.

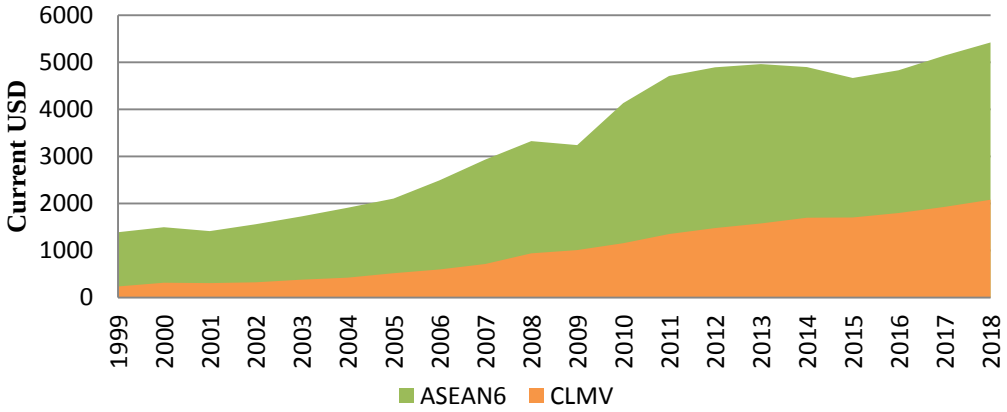


Figure 2.9: CLMV and ASEAN6 GDP per capita, USD, 1999-2018

Source: Author's calculation from data of World Bank (https://databank.worldbank.org/ reports. aspx?source=2&series=SP.POP.TOTL&country=#)

Hence, the process of "catching-up" seems to be occurring throughout ASEAN in relative terms. The catch-up effect theory shows that the income gap between a rich and a poor country will narrow if the lower income country can catch up with a higher income country in terms of economic growth. In 2005, the average per capita income of the ASEAN6 (US$2,104) was about four times the average of the CLMV (US$518), while it declined to approximately 3.5 times in 2010 (ASEAN6 with US$4,132 and CLMV with US$1,155) and declined further to about 2.6 times in 2018 (ASEAN6 with US$5,432 and CLMV with US$2,080) (see Table 2.4).

Although CLMV started from a much lower base, the CLMV had a faster growth in per capita income than that of the ASEAN6. In particular, Figure 2.10 shows that annual GDP per capita income growth during the period 1999-2017 of individual countries in the CLMV grew by between 5-9% while it was about 3-4% in individual countries in ASEAN6. Brunei was the exception with growth of -0.6%. The higher growth rate in per capita income as well as in economic growth will contribute to income convergence between the CLMV and ASEAN6 in the future, assuming that current growth trends continue.

Table 2.4: Ratio of income per capita (USD) between ASEAN-6 and CLMV

Year	ASEAN6	CLMV	Ratio of income per capita
1999	1389	236	5.87
2000	1495	316	4.74
2001	1413	308	4.59
2002	1559	325	4.80
2003	1726	381	4.53
2004	1909	424	4.51
2005	2104	518	4.06
2006	2491	598	4.17
2007	2934	714	4.11
2008	3326	940	3.54
2009	3241	1010	3.21
2010	4132	1155	3.58
2011	4710	1351	3.49
2012	4894	1477	3.31
2013	4963	1576	3.15
2014	4899	1697	2.89
2015	4668	1702	2.74
2016	4832	1798	2.69
2017	5144	1928	2.67
2018	5423	2080	2.61

Source: Author's calculation from data of World Bank (https://databank.worldbank.org/reports.aspx?source=2&series=SP.POP.TOTL&country=#)

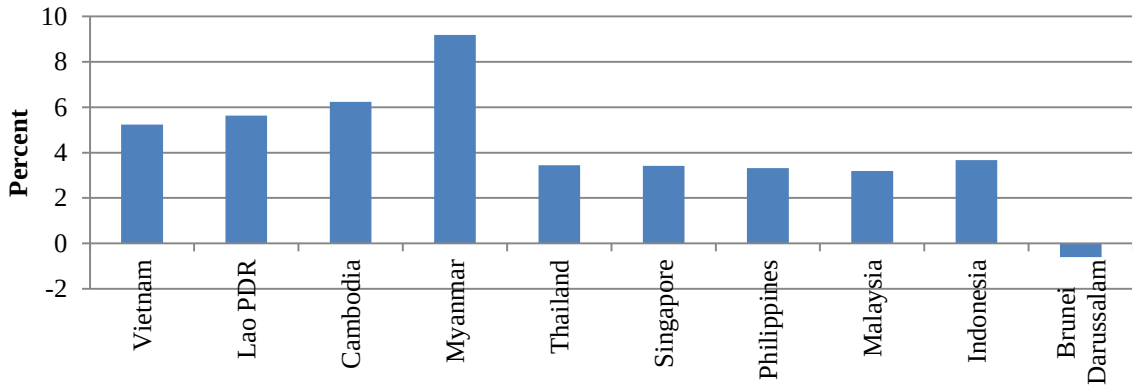


Figure 2.10: Average annual GDP per capita growth (1999-2017)

Source: Author's calculation based on annual GDP per capita growth collected from the World Bank website (https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?view=chart)

Significant efforts have been made to reduce the development gap among ASEAN countries and to decrease poverty and socio-economic disparities relating to the new ASEAN members, such as the Hanoi Plan of Action (HPA), Initiation for ASEAN Integration (IAI), Declaration of ASEAN Community and Declaration of Sixth ASEAN

Summit in Hanoi in December 1998 (Alavi & Ramadan 2008). It is also one of the key targets that ASEAN needs to narrow the income gap of its member countries as part of the process to become an equitable and inclusive economic development area to achieve an AEC (OECD 2013). Otherwise the AEC is unlikely to be successful with some of its members withdrawing on the grounds that they see no benefit to them if more integration takes place. The income gap became a focus of the 2013 Southeast Asian Economic Outlook, conducted by the Organization for Economic Co-operation and Development (OECD) and ASEAN Secretariat (Bock 2014).

Regarding the within-country income gap, Menon (2013) indicates that the improvement and benefits from high economic growth rates in ASEAN has been distributed unequally and, hence, income inequality has increased. Figure 2.11 indicates income inequality in ASEAN[19]. It can be seen that within-country income inequality of the lower income countries (CLMV) has grown fastest. The income inequality of the middle-income countries seems more stable. It can also be seen from this figure that the wealthier the country is, then the higher will be its income inequality. Specifically, the CLMV has the lowest Gini coefficient while the wealthiest and middle income countries have higher Gini coefficients.

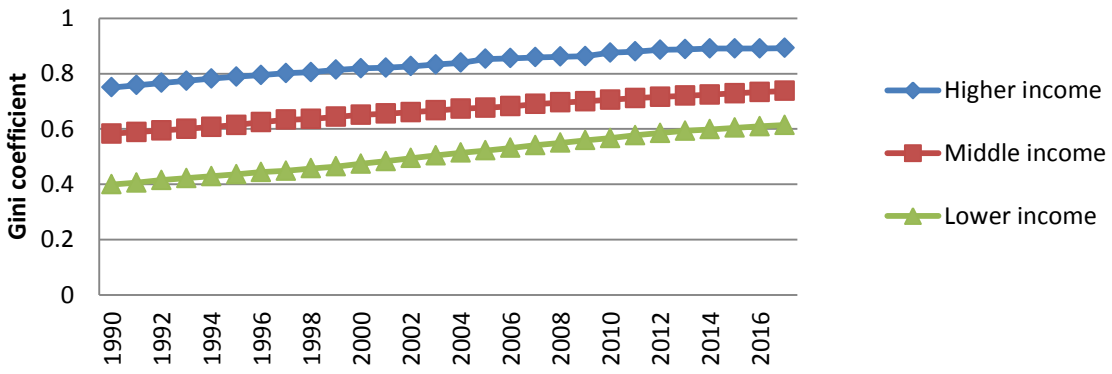


Figure 2.11: Income inequality of ASEAN, 1990-2017

Note: Wealthiest countries: Singapore and Brunei; Middle income countries: Malaysia, Thailand, Indonesia and the Philippines; CLV: Cambodia, Laos and Vietnam.

Source: Author's calculation from UNDP

[19] A higher Gini coefficient means higher income inequality.

OECD (2018) indicates that the within-country income inequality in CLMV has mainly stemmed from the process of industrialisation. Industrialisation is also accompanied by the concentration of entrepreneurs in urban areas, where entrepreneurs normally receive and can generate higher income. This is because labour productivity in cities due to industrialisation is higher while labour productivity in the rural areas is weaker. It results in a wider income gap between rural and urban areas. For growth to be sustainable it is important that all economic agents benefit from the growth process and by location (province and rural) and demography (males, females, young and old). This is because if income equitability is concentrated in the hands of the few, then this cannot sustain both higher overall demand and higher production and growth levels.

In addition, Okonjo-Iweala *et al.* (1999) showed that external shocks coming from the AFC had a negative impact on the income inequality of the poorer ASEAN countries such as Cambodia and Lao PDR. In particular, inflation in Cambodia which arose from the AFC distressed the rural communities and the poor. The devaluation of the Riel impacted badly on workers who had fixed incomes in Riel whereas it benefited workers paid in USD. In the case of Lao PDR, they state that the triple-digit annual inflation eroded real income and purchasing power. While the favourable Baht-Kip exchange rate and higher agricultural prices brought prosperity to wealthy farmers, the flipside was that poorer farmers and those with insufficient access to the markets had their real incomes eroded. It is evident that the exchange rate plays a role in driving within-country income inequality. Therefore, the critical issue is as follows: which exchange rate regime for ASEAN countries best enables the attainment of the AEC?

2.3.5.2. Human development gap

The UNDP has introduced the Human development index (HDI) to measure the socio-development since 1990s (Alavi & Ramadan 2008). This index has three dimensions,

namely life expectancy, education and a decent standard of living[20].

Table 2.5: Human development index of 10 ASEAN countries from 1999 to 2017

	Brunei	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1999	0.818	0.407	0.598	0.462	0.716	0.421	0.62	0.809	0.64	0.567
2000	0.819	0.42	0.606	0.466	0.725	0.431	0.624	0.819	0.649	0.579
2001	0.82	0.434	0.612	0.472	0.723	0.44	0.628	0.822	0.657	0.587
2002	0.823	0.453	0.618	0.48	0.725	0.449	0.633	0.83	0.666	0.595
2003	0.828	0.466	0.624	0.489	0.731	0.459	0.637	0.838	0.674	0.603
2004	0.834	0.478	0.629	0.497	0.734	0.468	0.647	0.845	0.683	0.612
2005	0.838	0.49	0.632	0.506	0.731	0.477	0.65	0.868	0.693	0.616
2006	0.84	0.502	0.641	0.512	0.737	0.487	0.651	0.871	0.699	0.624
2007	0.84	0.513	0.642	0.521	0.75	0.498	0.657	0.878	0.71	0.632
2008	0.84	0.521	0.646	0.529	0.761	0.509	0.661	0.883	0.714	0.64
2009	0.842	0.521	0.656	0.539	0.765	0.519	0.659	0.884	0.718	0.656
2010	0.842	0.537	0.661	0.546	0.772	0.53	0.665	0.909	0.724	0.654
2011	0.846	0.546	0.669	0.558	0.778	0.54	0.67	0.914	0.727	0.664
2012	0.852	0.553	0.675	0.569	0.781	0.549	0.677	0.92	0.731	0.67
2013	0.853	0.56	0.681	0.579	0.785	0.558	0.685	0.923	0.728	0.675
2014	0.853	0.566	0.683	0.586	0.79	0.564	0.689	0.928	0.735	0.678
2015	0.852	0.571	0.686	0.593	0.795	0.569	0.693	0.929	0.741	0.684
2016	0.852	0.576	0.691	0.598	0.799	0.574	0.696	0.93	0.748	0.689
2017	0.853	0.582	0.694	0.601	0.802	0.578	0.699	0.932	0.755	0.694

Source: UNDP; http://hdr.undp.org/en/statistics/understanding

It can be seen from Table 2.5 that there are improvements in HDI for all 10 ASEAN countries. The decline in HDI's standard deviation indicates that the HDI gap between ASEAN countries has decreased over the period 1999-2017 (see Figure 2.12). Following Alavi and Ramadan (2008), HDI is divided into 4 groups, namely low human development level (HDI is lower than 0.6), lower medium human development level (HDI is between 0.6 and 0.7), upper medium high human development level (HDI is between 0.7 to 0.8) and high human development level (HDI is higher than 0.8). Therefore, from Table 2.5, it can be seen that Brunei and Singapore have high human development while Cambodia, Laos and Myanmar have low human development. Indonesia (with the exception of 1999), Malaysia, Philippines and Thailand have lower medium human development. Vietnam has

[20] Life expectancy at birth is an indicator of life expectancy. According to OECD, "Life expectancy is defined as how long, on average, a newborn can expect to live, if current death rates do not change". Expected years of schooling and mean year of schooling are indicators for education dimension. GNI per capita, PPP is an indicator for a decent standard of living dimension.

climbed from low human development level to low medium human development level since 2003.

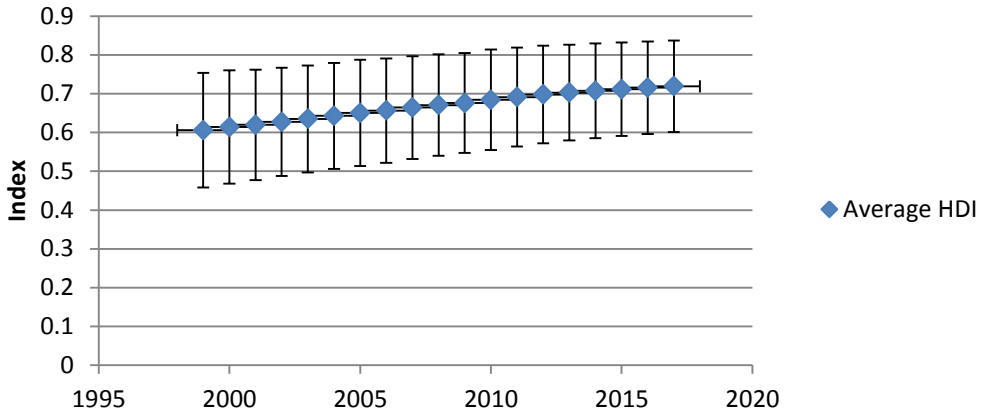


Figure 2.12: Average human development and standard deviation of ASEAN from 1999 to 2017

Source: Author's calculation from data of UNDP (http://hdr.undp.org/en/statistics/understanding)

Table 2.6: Life expectancy at birth for 10 ASEAN countries from 1999 to 2017

	Brunei	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1999	74.99	57.60	66.09	58.36	72.62	61.80	67.02	77.55	70.46	73.03
2000	75.20	58.43	66.29	58.92	72.80	62.13	67.17	77.95	70.62	73.27
2001	75.43	59.34	66.47	59.49	72.97	62.45	67.31	78.25	70.84	73.49
2002	75.65	60.28	66.64	60.07	73.11	62.76	67.43	78.55	71.11	73.70
2003	75.88	61.24	66.82	60.65	73.24	63.05	67.56	79.04	71.42	73.89
2004	76.09	62.19	67.00	61.22	73.36	63.32	67.67	79.49	71.78	74.08
2005	76.29	63.09	67.19	61.79	73.46	63.60	67.78	79.99	72.15	74.26
2006	76.46	63.93	67.39	62.35	73.58	63.88	67.89	80.14	72.53	74.44
2007	76.58	64.70	67.58	62.89	73.70	64.18	68.00	80.44	72.92	74.61
2008	76.66	65.39	67.78	63.40	73.85	64.50	68.11	80.79	73.28	74.78
2009	76.70	66.01	67.96	63.89	74.02	64.84	68.21	81.24	73.62	74.95
2010	76.72	66.56	68.15	64.36	74.21	65.18	68.32	81.54	73.92	75.12
2011	76.73	67.03	68.33	64.80	74.41	65.51	68.43	81.74	74.20	75.29
2012	76.76	67.47	68.51	65.21	74.61	65.81	68.55	82.00	74.45	75.48
2013	76.82	67.87	68.68	65.60	74.80	66.07	68.68	82.25	74.68	75.66
2014	76.92	68.25	68.86	65.98	74.98	66.29	68.81	82.50	74.90	75.86
2015	77.05	68.62	69.03	66.34	75.14	66.46	68.95	82.74	75.10	76.05
2016	77.20	68.98	69.19	66.68	75.30	66.61	69.09	82.85	75.30	76.25
2017	77.37	69.33	69.36	67.02	75.45	66.74	69.24	82.90	75.50	76.45

Source: World Bank; https://data.worldbank.org/indicator/sp.dyn.le00.in

Table 2.6 presents the life expectancy at birth for 10 ASEAN countries from 1999 to 2017. It can be seen from the Table 2.6 that ASEAN countries have a longer life span. In

addition, the higher income countries have a longer life span than the lower income countries. Furthermore, Figure 2.13 indicates that there is a significant gap in the average life expectancy at birth between ASEAN6 and CLMV. However, this gap has been reduced.

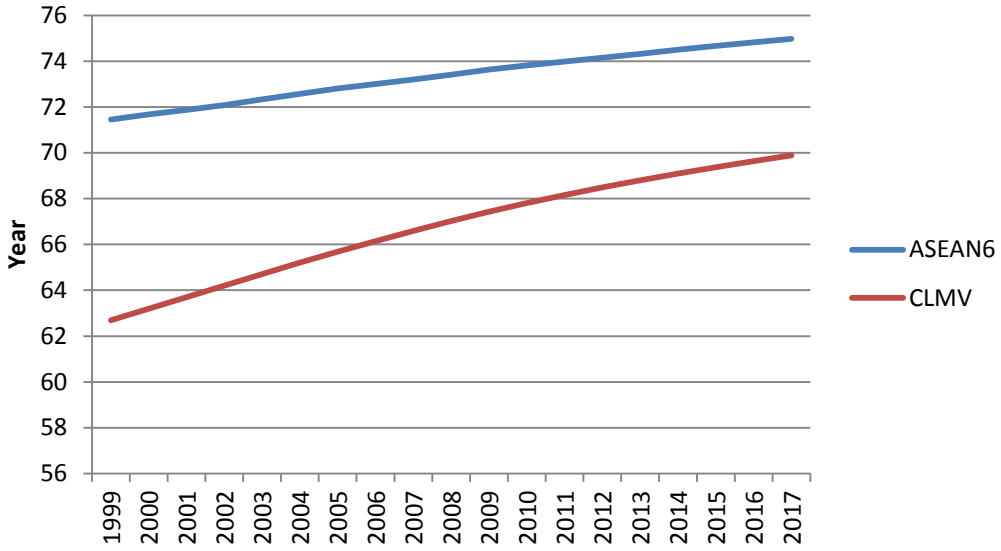


Figure 2.13: The gap in life expectancy at birth between ASEAN6 and CLMV from 1999 to 2017

Source: Author's calculation from data of World Bank (https://data.worldbank.org/indicator/sp.dyn.le00.in)

Table 2.7 indicates the data on the mean year of schooling of 10 ASEAN countries whereas the average expectancy years of schooling of ASEAN6 and CLMV is presented in Figure 2.14. According to UNESCO, the mean year of schooling is "the average number of completed years of education of a country's population aged 25 years and older" and expected years of schooling is "the number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life". It can be seen that the non-income development gap between ASEAN6 and CLMV is large. Table 2.7 shows that the richest countries such as Singapore and Brunei have on average about 8-11 years of schooling while CLV countries have the lowest average years of schooling (only about 3-5 years of schooling).

Table 2.7: The mean years of schooling of 10 ASEAN countries

	Brunei	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Viet Nam
1999	8.2	3.2	6.2	3.8	8.4	3	7.5	8.6	5.9	5.3
2000	8.3	3.2	6.7	3.9	8.6	3.1	7.6	8.9	6.1	5.4
2001	8.3	3.3	6.9	4	8.4	3.2	7.7	9.2	6.3	5.6
2002	8.4	3.3	7	4	8.2	3.3	7.9	9.5	6.5	5.8
2003	8.4	3.4	7.2	4.1	8	3.4	8	9.8	6.7	6
2004	8.4	3.5	7.3	4.2	7.8	3.5	8.6	10.2	6.8	6.2
2005	8.5	3.5	7.4	4.2	7.6	3.5	8.7	10.5	7	6.4
2006	8.5	3.6	7.9	4.3	8.2	3.7	8.8	10.1	7	6.6
2007	8.6	3.7	7.1	4.4	8.8	3.8	8.9	10.2	7.1	6.8
2008	8.7	3.9	7.1	4.4	9.4	3.9	9	10.5	7.3	7
2009	8.7	3.7	7.4	4.5	9.6	4	9	10.5	7.5	8
2010	8.8	4.4	7.4	4.6	9.8	4.1	8.9	11.2	7.7	7.5
2011	8.8	4.4	7.6	4.8	10.1	4.3	9	11.2	7.5	7.6
2012	8.9	4.5	7.6	5	10.1	4.5	9.1	11.3	7.7	7.8
2013	8.9	4.6	7.8	5.1	10.1	4.7	9.1	11.4	7.5	7.9
2014	9	4.7	7.8	5	10.1	4.8	9.2	11.4	7.6	7.8
2015	9	4.7	7.9	5.1	10.2	4.9	9.3	11.5	7.6	8
2016	9.1	4.7	8	5.2	10.2	4.9	9.3	11.5	7.6	8.1
2017	9.1	4.8	8	5.2	10.2	4.9	9.3	11.5	7.6	8.2

Source:UNDP (http://hdr.undp.org/en/data#)

Figure 2.14 shows that there is an improvement in the expected years of schooling on both ASEAN6 and CLMV countries. However, the gap in expectancy years of schooling between ASEAN6 and CLMV is wide and persistent.

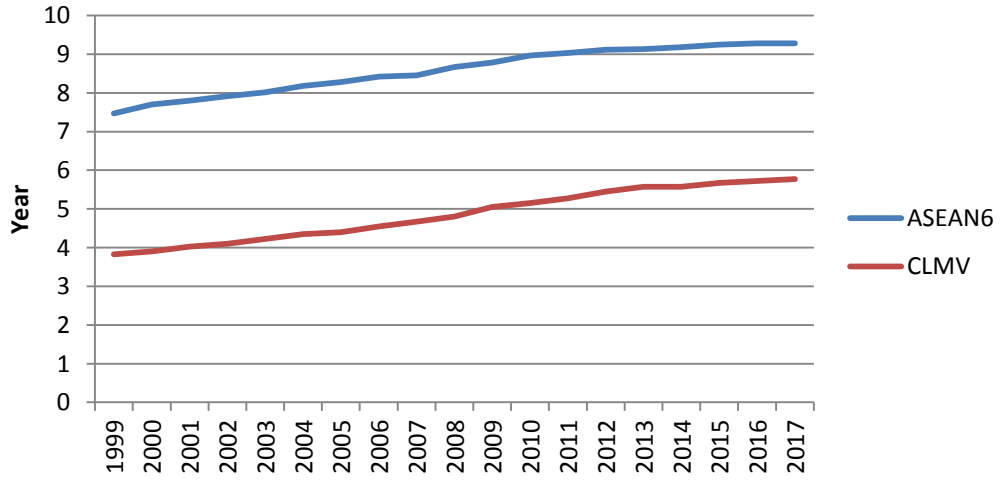


Figure 2.14: The average expectancy years of schooling of ASEAN6 and CLMV

Source:Author's calculation from UNDP (http://hdr.undp.org/en/data#)

2.4. TRADE AND INVESTMENT FLOWS OF THE ASEAN COUNTRIES

As mentioned earlier the economies of ASEAN were greatly affected by shocks in the form of the AFC and GFC. Disturbances from international trade and investment, which derived from external difficulties such as the global financial crisis and severe economic downturn in the developed economies, caused volatility in economic growth, output and inflation for the ASEAN countries. Yang (2013) argues that external shocks have a greater impact on the business cycles and macroeconomic policy of Asian countries since the AFC because they have become more integrated into the world economy.

2.4.1. Trade linkages

ASEAN countries have close trade linkages to the rest of the world, as expressed by high trade openness, a high trade share in GDP and dependence on trade for employment. In particular, the value of trade between ASEAN to the rest of the world has risen dramatically from US$9.7 billion in 1967 to US$2.2 trillion in 2016. ASEAN's trade accounted for 7% of total global trade and in 2016 it was the world's 4th largest exporting region. In addition, the contribution of ASEAN to world exports has increased gradually by about 6-7% annually since Myanmar, the last member country, joined ASEAN in 1999 (see Figure 2.15).

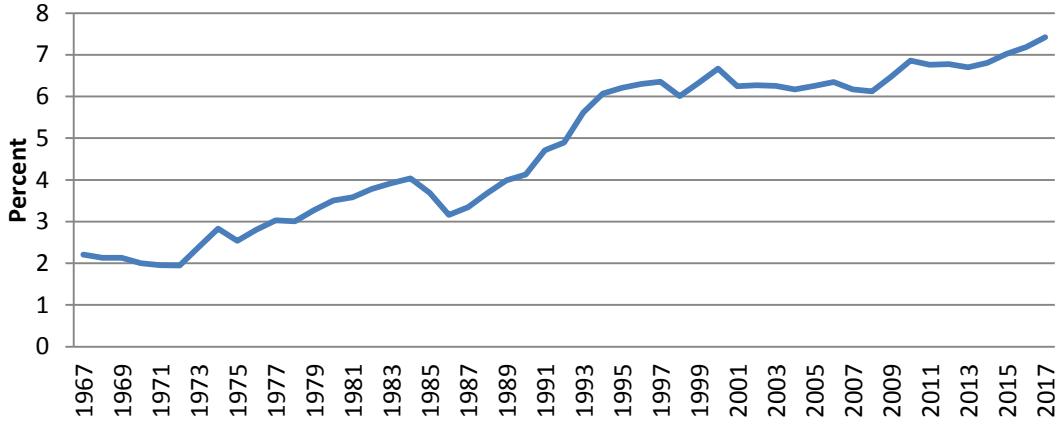


Figure 2.15: ASEAN's share of world exports (%), 1967-2017

Source: UNCTAD website (*https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx)*

From Figure 2.16 and Figure 2.17, it can be seen that both imports and exports of goods and services moved in tandem. Exports and imports of goods rose moderately from 1967 to 1984, followed by rapid increases in trade in the following years. However, they both experienced sharp decreases during the AFC and GFC due to the fall in global demand. Furthermore, exports and imports of services grew gradually with an annual growth rate of about 9-10% from 1999 to 2016. They were also negatively affected by the GFC with a significant dip in 2009.

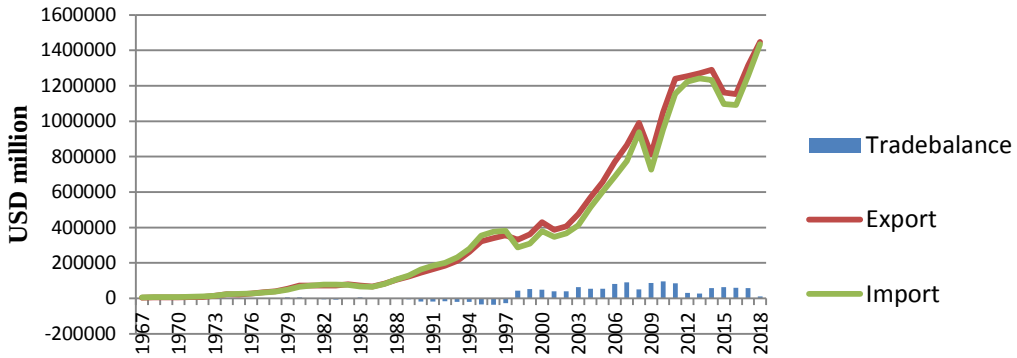


Figure 2.16: Exports and imports of goods by ASEAN

Source:UNCTADstat (https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx)

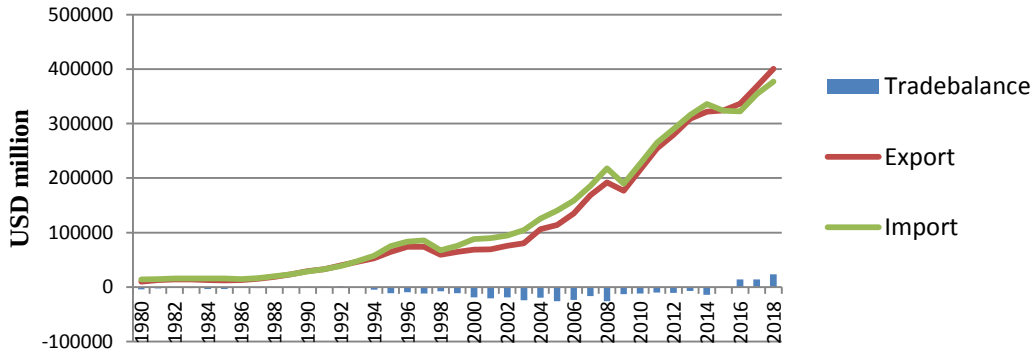


Figure 2.17: Exports and imports of services by ASEAN, USD million

Source:UNCTADstat (https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx)

ASEAN member countries are becoming more internationalised with high trade openness which is measured by total exports and imports to GDP (see Figure 2.18). Remarkably, the average openness of ASEAN is much higher than that of the world (see Figure 2.19). In 2016, Singapore had the highest trade openness, followed by Vietnam of

the ASEAN countries. The ASEAN transitional economies (Cambodia, Lao PDR, Myanmar and Vietnam) especially have experienced impressive internationalisation when moving from relatively closed to open economies. A good example is Vietnam, which has experienced an increase in trade openness from 66% in 1993 to 184.7% in 2016. Cambodia has also experienced a significant change in trade openness with a rise from 49% in 1993 to 127% in 2016. Remarkably, the trade openness of Myanmar jumped from just 1% in 2000 to 39% in 2016.

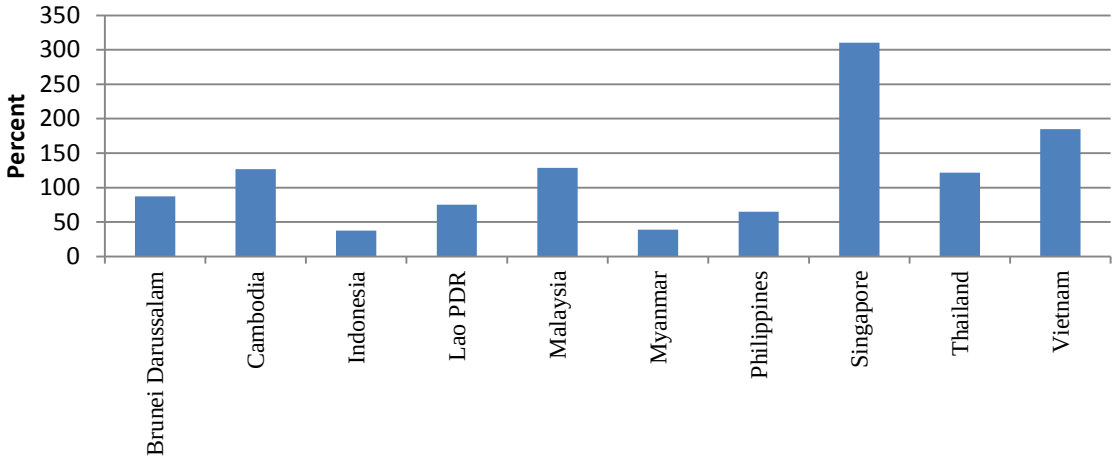


Figure 2.18: Trade openness of ASEAN countries, trade/GDP ratio, 2016

Source: World Bank website (https://databank.worldbank.org/data/reports.aspx? source=2&series= NE.TRD.GNFS.ZS&country=)

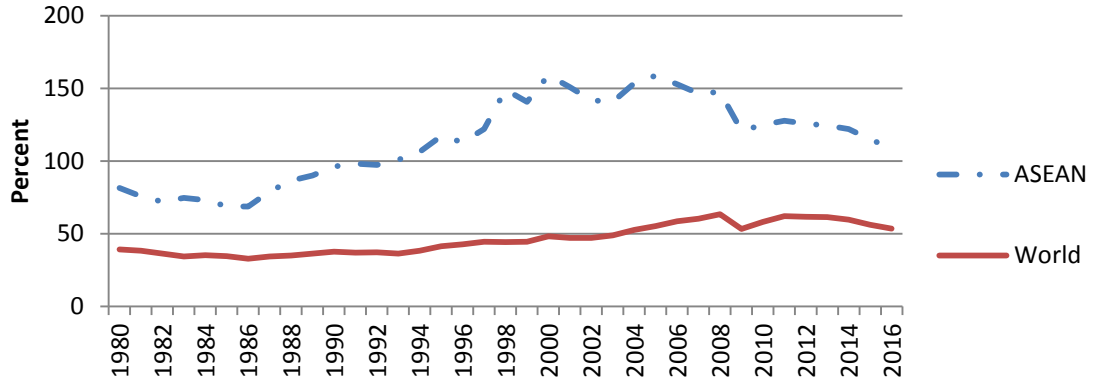


Figure 2.19: Trade openness of ASEAN and the world, trade/gdp ratio, 1980-2016*

* Data from 1980 to 2013 are from the Balance of Payments Manual 5 (BPM5) and data from 2014-2016 are from Balance of Payments Manual 6 (BPM6).

Source: UNCTAD website (https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx? ReportId =24397)

Figure 2.20 indicates the trade composition of ASEAN. It can be seen that about 75-80% of ASEAN trade is with countries that are not members of ASEAN[21]. This suggests that regional economic integration in ASEAN still has a long way to go. However, the development of production networks, which is one of the goals of the AEC, may assist in the further regional economic integration of ASEAN.

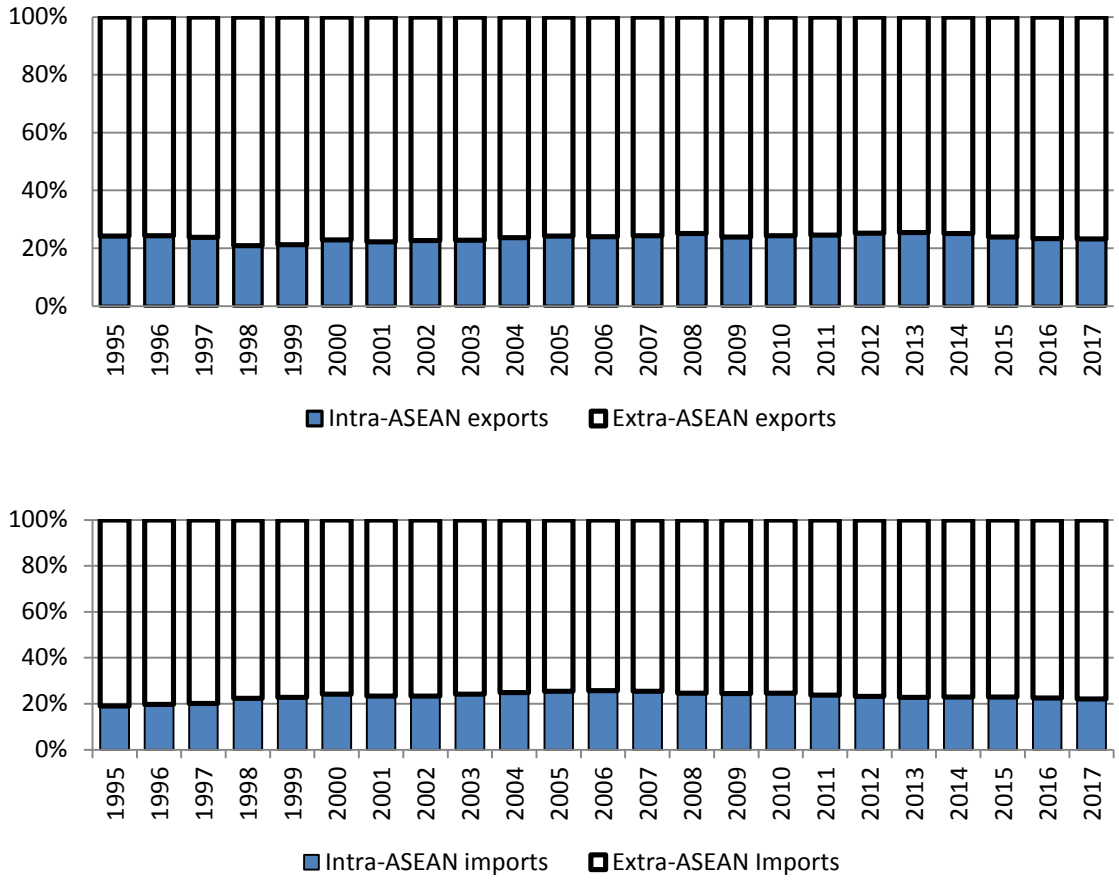


Figure 2.20: The composition of ASEAN trade

Source: UNCTAD website (*https://unctadstat.unctad.org/wds/TableViewer/tableView. aspx?ReportId=24397)*

Figure 2.21 illustrates the average annual growth rate of trade volumes for ASEAN. It can be seen that both export and import volumes have achieved high growth rates. Nonetheless they experienced sharp declines during the AFC, Dot.com bubble crash and GFC.

[21] The main trading partners of ASEAN in 2015 were the United States, Japan, EU, China, South Korea, Taiwan, Hong Kong and Australia.

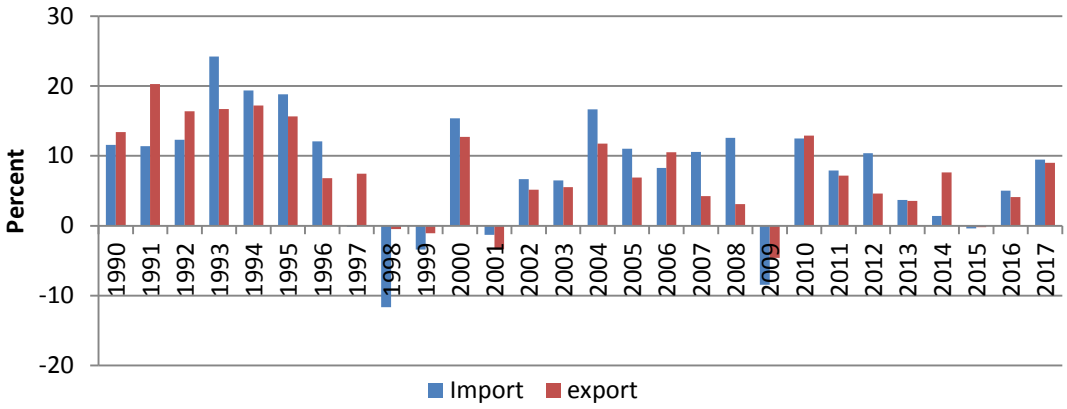


Figure 2.21: The average annual growth rate of export and import volumes for ASEAN, 1990-2017*

* Excluding Cambodia and Myanmar
Source: Author's calculation from the World Economic Outlook 2018-IMF website

2.4.2. Investment flows

According to Almekinders *et al.* (2015), FDI flows have been the main channel for the global financial integration of ASEAN. A major objective of ASEAN is to provide a competitive production base for multinational enterprises and to attract FDI inflows. However, it also pays attention to regional financial integration, which requires the openness of financial services and capital flow liberalisation. According to Yang (2013), financial openness is measured by the ratio of capital inflows and capital outflows to GDP. Capital flows (total short and long run capital) include foreign direct investment, portfolio investment and other investment. ASEAN is embracing greater capital account liberalisation with the aim of higher capital account openness but with sound financial stability.

Attracting FDI from outside and inside ASEAN is one of the main objectives of economic cooperation and integration of the ASEAN countries. Figure 2.22 shows the net FDI inflows to ASEAN, measured by share of total world FDI. It includes flows from intra-ASEAN and extra-ASEAN sources. It is evident that despite ASEAN's share of world FDI inflows declining during the AFC and the GFC, it has recovered to levels during

the period before the AFC. The share of FDI inflow to the world total declined from 2014-2016 because of the general decline in FDI inflow to developing countries. Further to this, the fall in FDI inflows in 2016 resulted from certain factors such as divestment, large repayment of intracompany loans, and the acquisition of foreign assets by ASEAN companies in their home countries (ASEAN 2017a).

A number of factors have increased the attractiveness of ASEAN as a destination for FDI, including lower labour costs in manufacturing compared to that in China, geopolitical considerations and reductions in trade and investment barriers as part of the commitment to achieving the AEC. Nonetheless, World Bank (2014) indicated that restraints on foreign ownership, mainly in the services sector, should be eased to attract more FDI (Almekinders *et al.* 2015). In addition, infrastructural improvement as well as access to more skilled labour is necessary to enable ASEAN to attract more FDI.

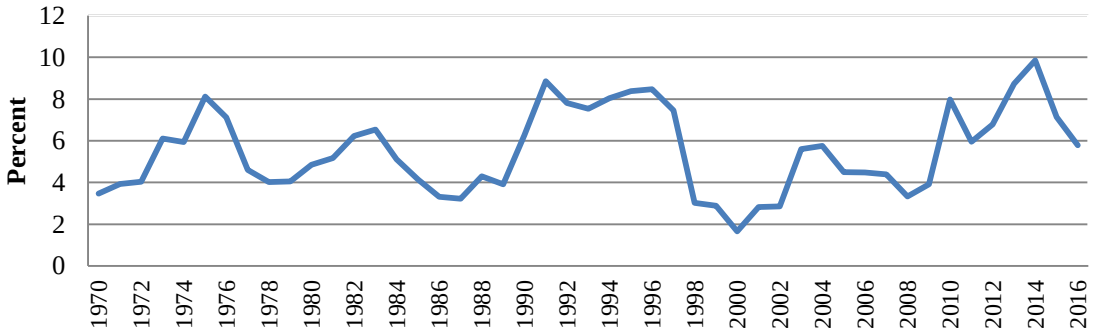


Figure 2.22: Net FDI inflows to ASEAN as a percentage of total world net FDI (1970-2016)

Source: UNCTAD website

Menon and Chongvilaivan (2011) point out that after the GFC the level of foreign capital inflows (including both FDI and short-term capital) recovered rapidly because of the recovery of confidence by foreign investors in the ASEAN economy. Nonetheless, the large increase in capital inflows, especially private short-term capital inflows, raised a number of issues. *First*, it can lead to the possibility of a similar capital reversal as experienced in the 1997 AFC. *Second*, it can result in difficulty in managing risks coming

from the dramatic surge of short-term capital inflows. The speedy surge in short-term capital inflows may result in domestic currency appreciation which in turn results in extreme losses in terms of output (Menon & Chongvilaivan 2011). *Finally*, the large capital inflow may lead to real exchange rate appreciation which then reduces competitiveness.

2.5. CHALLENGES FACING ASEAN IN THE PROCESS OF ECONOMIC INTEGRATION

In spite of rapid development and progressive integration, ASEAN's member economies are faced with diversity and income disparity. Due to changes in the global environment, ASEAN countries have to cope with common risks originating from the world economy and hence they should identify strategies to stimulate development in the region.

2.5.1. Macroeconomic and financial stability

More regional and global integration has enabled ASEAN countries to establish strong interconnections with their region and the rest of the world. However, this makes ASEAN countries more dependent on the world economy. Hence, ASEAN countries may be more vulnerable to shocks coming from international markets (Chirathivat *et al.* 2015; ADBI 2016).

Export-driven growth has made ASEAN become more dependent on global growth and demand as a result, with volatility of global demand making the region become more sensitive to such changes (Rillo 2009). A salient feature of the ASEAN countries is their high level of trade openness. This makes ASEAN economies highly vulnerable to external shocks which potentially can trigger economic instability.[22] Raddatz (2007) points out

[22] A high degree of openness makes small open economies in particular more vulnerable to external shocks. See Loayza and Raddatz (2007).

external shocks impinge negatively on the economic growth of developing countries and cause macroeconomic instability. Moreover, as indicated by Masron and Yusop (2008), many developing countries had sunk into deeper recessions coming from external shocks such as oil price shocks.

It is evident that greater integration and interdependence increases the risk of contagion from a crisis, because shocks coming from one country can affect other economies in a region or free trade area (Chirathivat *et al.* 2015; ADBI 2016). As a result these risks may affect the macroeconomic and financial stability of ASEAN countries. Therefore, ASEAN may not achieve the aims of the AEC and, hence, it may lead to the latter failing (Chirathivat *et al.* 2015). ADBI (2016) highlights that the crucial target of a nation is to maintain the stability of its macro-economy and finance sector when faced with external shocks.

2.5.2. The income gap

From Section 2.3, it can be seen that ASEAN countries have attained an improvement in their economic growth and income per capita. However, the income gap across and within countries, between urban and rural and between income groups within countries has increased (ADBI 2016). One of the pillars for the AEC is equitable economic development in which ASEAN countries are pledged to ensure that the development gap, in particular the income gap, between member countries is reduced (McGillivray & Carpenter 2013). However, macroeconomic volatilities arising from external shocks can lead to wider income gaps amongst ASEAN countries, thus posing a serious threat to the success of the AEC in attaining one of its critical pillars for success - equitable economic development.

Moreover, in terms of the income gap within countries, as emphasised by ADBI (2016), on average the rich seem to get more benefits from growth than the poor and,

hence, ASEAN cannot attain sustainable prosperity if there inequality is on the rise. It also points out that a failure to reduce inequality creates a society where individuals face an imbalance in opportunities. Any increase in income disparity is politically unacceptable, dangerous and unsustainable and hence it damages the idea of ASEAN as a family of nations. It concludes that if a large income gap is maintained it makes achieving consensus among ASEAN members on common development agenda more difficult.

Plummer and Chia (2009) argue that greater income inequality within a country can cause a serious problem such as blaming the establishment of the AEC for this development, which then erodes the political will to implement policies inherent in the AEC. They also believe that income inequality can harm economic growth. Hence, they conclude that addressing within-country income inequality, as well as across ASEAN members, are essential for the success of ASEAN from both political and economic perspectives.

2.5.3. The exchange rate regime as an instrument to overcome challenges

The AEC promotes greater integration amongst ASEAN member countries and as such external shocks are transmitted between countries at greater speed. Accordingly, the macroeconomic policy of individual ASEAN countries should be designed in such a way as to ensure that their economy is resilient to domestic and external shocks and volatilities (ADBI 2016). Furthermore, according to the joint statement made by the Finance Ministers and Central Bank Governors of ASEAN countries at the 2nd Meeting in Vientiane, Lao PDR on 4th April 2016, in dealing with external challenges, ASEAN is committed to conducting suitable monetary, fiscal and macro-prudential policies to enhance macroeconomic and financial stability as well as to achieve sustainable economic growth[23].

In the literature, the exchange rate regime serves as an instrument to reduce the

[23] Macro-prudential policy aims to ensure financial stability and address risks and volatilities

volatility of macroeconomic variables such as output, the real exchange rate and price level from external shocks. It may be used as a tool to reduce the income gap for ASEAN countries for the following reasons: first, the exchange rate is an important channel through which the effects of fluctuations of external variables on domestic macroeconomic variables such as output and price are transmitted (Tng & Kwek 2015); second, exchange rate policy plays a role in ensuring macroeconomic stability and economic growth (Mühlich 2014). This in turn may affect the income gap between and within ASEAN countries. Moreover, Masron and Yusop (2008) show that external shocks are considered as a factor leading to a greater income gap for ASEAN countries. It can be explained that the responses of the economy to shocks can vary due to different exchange rate regimes adopted. Therefore, exchange rate policy can play a role in minimising the income gap through absorbing external shocks. However, this issue has been missing in the policy discussion as well as in the literature and, hence, this line of enquiry is the focus of this thesis.

2.6. CONCLUDING REMARKS

ASEAN, which is made up of ten economically diverse countries, namely Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam, established the AEC in 2015 with the aim of closer regional economic integration by 2020. The pillars underpinning the AEC are to: attain a single market, make the region a competitive production base, to achieve equitable economic development and full integration into the world economy. With reference to the pillar of equitable economic development, the AEC wants to ensure that the benefits of regional integration are distributed as equally as possible to member countries.

Although the AEC brings obvious opportunities it also carries with it challenges and risks to ASEAN countries. A good example is that economic integration makes ASEAN

countries more interdependent and, hence, susceptible to external shocks coming from regional and global economies. These external shocks can lead to contagion because shocks coming from one country may affect another country. In particular, these shocks impact on member countries in different ways, which may exacerbate existing member countries' income gap. Thus, this poses serious threats to the success of the AEC in attaining one of its critical pillars for success - equitable economic development. Additionally, despite the positive economic growth and increases in per capita income in recent times, ASEAN countries are currently facing within-country income inequality. This can also harm the sustainability of future economic growth.

In theory, and in practice, the exchange rate regime is an important instrument for insulating an economy from external shocks and, therefore, exchange rate policy is considered to have an important role to play in dealing with challenges on the progress of the AEC such as macroeconomic instability, unsustainable economic growth and income gap issues. It may play a role in reducing income inequality within a country through its impacts on macroeconomic variables. Nonetheless, the role of the exchange rate policy in terms of its impact on the between and within countries income gap has not been investigated before in the literature. It is here that the thesis makes an important contribution to the literature and to policy decisions in ASEAN and its member countries.

This study aims to investigate which exchange rate regime (fixed or flexible) can minimise the adverse effects of various external shocks on key macroeconomic variables such as output, price level and real exchange rate, and reduce the income gap between and within ASEAN countries and to attain the AEC objectives. For this reason, it is necessary to discuss and better understand the role of the exchange rate regime in buffering external shocks and maintaining economic stability, which will be presented in the next chapter - the literature review.

CHAPTER 3: LITERATURE REVIEW

3.1. INTRODUCTION

The establishment of the AEC in 2015 represented a major landmark in regional economic integration in ASEAN. As discussed in Chapter 2, high trade openness, export-orientated growth and more regional and global integration may make the ASEAN economies more vulnerable to external shocks from the world economy such as foreign demand and world real oil price shocks. This may affect the success of the AEC in reducing the income gap between and within ASEAN members, maintaining regional macroeconomic stability and for the region to become fully integrated into the global economy.

In the literature, the exchange rate regime can be an instrument to cope with external shocks. Hence, exchange rate policy, specifically the exchange rate regime adopted, could be an important policy instrument for individual ASEAN countries in dealing with external shocks to ensure the stability of macroeconomic variables such as output, the real exchange rate and price level.

This chapter is structured as follows. The importance of external shocks on ASEAN economies will be presented in Section 3.2. Section 3.3 will shed light on relevant literature relating to the role of exchange rate regimes in transmitting the effects of shocks to key macroeconomic variables. To review the choice of exchange rate regime in the case of regional integration, Section 3.4 discusses the issue of an optimal currency area. The link between macroeconomic variables and the income gap within and between countries will be illustrated in Section 3.5. Based on the literature review, research gaps will be identified in Section 3.6. Finally, concluding remarks for this chapter will be provided in Section 3.7.

3.2. EXTERNAL SHOCKS MAY BE A PROBLEM FOR ASEAN COUNTRIES

External shocks play an important role in ASEAN countries and can even be more important than domestic shocks. Zaidi *et al.* (2013) investigated the importance of domestic and foreign shocks coming from the US and Japan, namely a commodity price shock, interest rate shock and GDP shock on key macroeconomic variables (real output, inflation, interest rate and the real effective exchange rate) for three ASEAN economies, Malaysia, Indonesia and Thailand. They found that their fluctuation (especially in the medium and long-run) is mainly explained by foreign factors such as commodity prices, foreign interest rates and foreign GDP shocks. In particular, the outputs of Malaysia and Thailand were more affected by foreign interest rate shocks than domestic interest rate shocks. Also, they discovered that the impact of foreign monetary policy shocks on Malaysia's inflation rate is more immediate compared to domestic monetary policy shocks. For Thailand and Indonesia, they concluded that foreign monetary policy shocks have similar effects to that of domestic monetary policy shocks on the volatility of inflation.

This study made some important contributions to the literature. Firstly, it used non-recursive SVAR where restrictions are based on the theory of the relationship between variables. In addition, it was assumed here that exogeneity of foreign shocks are used to avoid impacts of domestic variables on foreign shocks. However, this study did not conduct any test for this assumption such as the Granger causality test. In addition, the sample (from February1982 to February 2008) did not include the GFC which affected these economies. Finally, these countries are highly integrated into the world economy in terms of trade and, hence, their economies are affected by more types of shocks such as a foreign demand shock. However, this type of shock was not considered in this study.

Similarly, by conducting a structural VAR model for 8 emerging countries including some ASEAN countries such as Malaysia, Thailand, Singapore and the Philippines during the period from January 1986 to December 2000, Maćkowiak (2007) discovered that external shocks are important factors impacting on macroeconomic volatility (short-term interest, exchange rate, real aggregate output and aggregate price level). In particular, about 50% of the fluctuation of the exchange rate and price level is explained by external shocks such as the Federal Funds rate, world commodity prices, U.S. money stock, U.S. real aggregate output and U.S. aggregate price level. Furthermore, external shocks are responsible for about 40% and 33% of the variation of real output and the short-term interest rate of emerging countries, respectively. The positive point of this study is that it covered various types of external shocks coming from sources such as the commodity market, money market and financial market. Nevertheless, while exchange rate regime plays an important role in transmitting the effects of shocks on domestic variables, this study did not investigate the contribution of shocks to the volatility of domestic variables under different exchange rate regimes.

Basnet and Upadhyaya (2015) found that world real oil price shocks do not wield a long-run impact or significantly contribute to the variables, namely real GDP, inflation and real exchange rate of the ASEAN5[24]. However, this study did not conduct any test for the exogeneity of the world oil price. In addition, this paper did not consider the role of the exchange rate regime in transmitting the impact of world real oil price shocks on the ASEAN5 economy. A good example is that a rise in the world oil price leads to an increase in demand for foreign currency. This may or may not cause changes in the nominal exchange rate depending on which exchange rate regime that a country is applying. If a fixed exchange rate regime is applied then there is no change in the nominal

[24] Thailand, Malaysia, Singapore, the Philippines and Indonesia

exchange rate. Nonetheless, the nominal value of the domestic currency decreases under a flexible exchange rate regime. As a result the real exchange rate changes differently under different exchange rate regime.

The importance of external shocks has changed over time. A good example is found by investigating the contribution of external shocks to the volatility of domestic variables, including real GDP, the producer price index and the nominal exchange rate of East Asian economies, which include some ASEAN countries such as Indonesia, Malaysia, Thailand, Singapore and the Philippines from 1990Q1 to 2012Q2. Allegret *et al.* (2012) found that real oil price shocks, trade shocks, external financial shocks and monetary shocks have increased since the mid-1990s because of increased trade liberalisation by East Asian countries[25]. The positive point of this study is that it included different types of shocks from different sources such as real shocks, financial shocks and monetary shocks. However, like previous studies the role of the exchange rate was not considered in this analysis.

Recently, efforts have been made to discover the importance of external shocks on the ASEAN countries, because of their increasing high degree of trade openness and efforts at closer regional integration and cooperation. Hence, investigating the effects of external shocks on this region can make an important contribution to identifying effective policies for their integration and cooperation. Nonetheless, as indicated by Zaidi *et al.* (2013), studies on this issue remain limited. Previous studies have been mainly constrained in their focus to only a subset of the 10 ASEAN member economies such as Singapore, Indonesia, the Philippines, Malaysia and Thailand. Moreover, although financial linkages represent a key channel in transmitting external shocks to ASEAN countries (Majuca 2013; Sethapramote 2015), but the role of the exchange rate regime in

[25] The monetary shock and financial shock are proxied by U.S short-term interest rate and MSCI World Index (Morgan Stanley Capital International), respectively.

transmitting the effects of external shocks to the macroeconomic variables of all ten ASEAN countries has not been investigated as yet. For these reasons, it is necessary to evaluate in more detail these impacts, as well as the importance of external shocks, on ASEAN countries through the exchange rate regime.

3.3. THE ROLE OF THE EXCHANGE RATE REGIME ON MACROECONOMIC VARIABLES

3.3.1. Traditional theory

The idea that a flexible exchange rate regime is an efficient real shock absorber was initiated by Meade (1951) and Friedman (1953). They showed that with imperfect goods markets (i.e., price and wage stickiness) the adjustment speed of relative prices between domestic and foreign goods to real shocks depends on the exchange rate regime. In particular, under a flexible exchange rate regime relative prices will adjust immediately through adjustment of the nominal exchange rate. Therefore, the large adjustment of relative prices changes the domestic price of export goods which in turn makes the movement of real output smoother. As a result, the negative effect of real shocks on output will be partly offset under a flexible exchange rate regime.

However, under a relatively fixed exchange rate regime the adjustment of relative prices is much slower because it can only change at a limited speed based on the adjustment of the nominal exchange rate and prices. This can only occur with a decline in output relative to full employment which then puts downward pressure on wages and prices which tend to be sticky and adjust only slowly. Output will have to decline and more time will be needed to achieve lower domestic prices. Hence, the decline of output under a fixed exchange rate can be anticipated to be larger and more long-lasting in comparison a flexible exchange rate. However, these studies only mentioned general real shocks, not a specific real shock such as a terms of trade shock (TOT), foreign demand shock and real

interest rate shock. Also, they did not consider the degree of capital mobility and trade openness which affect adjustment of the nominal and real exchange rate via changes in tradable goods and capital flows. These studies only considered the fluctuation of output, not the stability of real exchange rate and price level, as a criterion for the superiority of the exchange rate regime.

The perspective concerning the choice of exchange rate regime provided by Meade (1951) and Friedman (1953) has been extended by other studies. Fleming (1962) and Mundell (1963) found that the superiority of a fixed or flexible exchange rate regime depends on the type of shock and mobility of capital. They pointed out that in a small open economy with a high degree of capital mobility, a fixed exchange rate regime is a better absorber of nominal shocks, such as changes in money demand or supply, whereas a flexible exchange rate regime is superior in buffering real shocks. However, these studies did not point out a specific real shock or nominal shock, nor did they consider the source of shock such as external or domestic and the degree of openness. This is because the last point affects trade flows which in turn causes changes in the real exchange rate under different exchange rate regimes.

Moreover, Moosa (2005) concluded that both types of exchange rate regime can be a shock absorber. The choice of a fixed or a flexible exchange rate regime depends on whether the shocks are domestic or external. In particular, a flexible exchange rate regime is better in dealing with external real shocks, external nominal shocks and internal real shocks, while a fixed exchange rate regime is superior in dealing with domestic nominal shocks. Nonetheless, the author did not indicate certain criteria for his conclusion on the superiority of the exchange rate regime on the stability of output, the real exchange rate, price level and economic growth.

Poole (1970) and Turnovsky (1976) who allowed for capital mobility found that the

stability of output depends on the type of shocks and a country's chracteristics. In particular, output is more stable under a flexible regime if the shocks come from foreign trade or foreign prices. However, a fixed regime attains greater output stability if the shock arises from the domestic monetary sector. Additionally, they showed that the superiority of the exchange rate regime to deal with other shocks such as a domestic demand shock, domestic price shock and capital flow shock depends on the degree of capital mobility or intervention. A good example is that a fixed exchange rate regime is better at minimising the fluctuation of output to domestic demand shocks if a country has a low integrated capital market. Nonetheless, a flexible exchange rate regime can create greater output stability where a higher degree of capital mobility exists. These studies, however, simply focused on the stability of output, not other variables to decide the superiority of an exchange rate regime.

Krugman and Taylor (1978), however, showed that a flexible exchange rate regime might not be superior to a fixed exchange rate regime in all circumstances. By assuming the existence of a trade deficit, they indicated that depreciation under a flexible rate regime can cause a contraction of national output because the import cost is greater than export revenue in terms of domestic currency[26]. Similarly, devaluation under a fixed exchange rate regime also has a contractionary impact on output. Therefore, it can be seen that under a fixed and flexible exchange rate regime, both a depreciation and devaluation can lead to output contraction. Therefore, a flexible exchange rate regime may not be better than a fixed regime in insulating the negative effect of a shock on output. Similar to previous studies, this study only considered the fluctuation of output to decide which exchange rate regime is better.

[26] Bahmani-Oskooee *et al.* (2002) explain the reason why a depreciation could have a contractionary effect on output. A depreciation leads to a higher price of intermediate imported goods, which then reduces output supply and increases inflation. The increase in inflation offsets the gain in competitiveness from the exchange rate depreciation. They illustrated that although export-oriented Asian economies had experienced depreciation during the AFC, domestic production decreased and inflation increased.

In addition, Mundell (1961) pointed out that a fixed exchange rate regime is the best for small open economies, which are affected by asymmetric real shocks, in reducing the fluctuation of the real exchange rate and then output volatility. McKinnon (1963) also indicated that more open economies prefer a fixed exchange rate regime than a flexible one because the former plays a role in reducing output volatility. For an example of this view, Kunroo (2015) showed that a negative TOT shock causes domestic currency depreciation which leads to an increase in the price of tradable goods. Therefore, if the authorities aim to stabilise the general price level then domestic demand is required to reduce the price of non-tradeable goods. The more open an economy is, then the greater contraction that is required and this leads to smaller GDP. Although these studies covered the degree of openness in the choice of exchange rate regime, the criteria for their conclusion was restricted to the volatility of output.

Some studies change the underlying assumptions and criteria when comparing the effects of shocks between a fixed and a flexible exchange rate regime. A good example is that by changing the assumption, namely capital immobility and the criterion of consumption stability, Fischer (1977) and Frenkel and Aizenman (1982) found contrary results; in particular, a flexible exchange rate regime is better in dealing with a nominal shock and a fixed regime in dealing with buffering a real shock. Flood (1979), Joshua (1983) and Melvin (1985), who focused on minimising domestic price instability, concluded that a fixed exchange rate regime is prefererable for insulating domestic prices from a nominal shock. Nevertheless, these studies did not separate a particular type of real or nominal shock nor did they differentiate the source of shock, i.e. whether foreign or domestic.

Devereux and Engel (2003) showed that the merit of a fixed or flexible exchange rate regime in coping with shocks depends on the currency used to set the price of goods. In

particular, if the imported goods are priced in domestic currency (local currency pricing - LCP) then the price is not affected by changes in the exchange rate. Therefore, a flexible exchange rate is less powerful in varying relative prices. This limits the superiority of a flexible exchange rate regime in insulating monetary shocks. In contrast, if the price of imported goods is set in foreign currency (Producer currency pricing - PCP) then the impact of changes in the exchange rate on consumer prices is immediate. As a result, the flexible exchange rate regime outweighs a fixed exchange rate regime in buffering monetary shocks.

Some studies considered wage indexation and price flexibility in examining the superiority of a fixed and flexible exchange rate regime. Marston (1981) concluded that the difference in output fluctuation from shocks (internal and external monetary and aggregate demand shocks) between a fixed and a flexible exchange rate regime is affected by the degree of wage indexation. In particular, there is less difference in output volatility between a fixed and a flexible exchange rate regime if a country has a higher degree of wage indexation. Moreover, a flexible exchange rate regime helps a country cushion against foreign shocks better if foreign countries have a perfect or higher degree of wage indexation than the home country. Furthermore, by assuming the existence of purchasing power parity, Aizenman (1985) pointed out that a higher degree of wage indexation leads to the superior ability of the flexible exchange rate regime to deal with aggregate supply shocks and monetary shocks. Despite looking at the characteristics of an economy while investigating the effects of shock across exchange rate regimes, these studies only considered the stability of output for their choice.

By noting the presence of foreign currency debt, Cook (2004) emphasised that emerging countries having a high foreign currency debt prefer a fixed exchange rate regime to a flexible exchange rate regime. This is because under the latter, a depreciation

arising from world real interest rate shock and foreign demand shock makes foreign-currency borrowing increase in terms of domestic currency, which then increases the cost of capital and reduces domestic firms' profit. This leads to investment and output contraction. Similar to other studies, the analysis only considered the response of output to the shocks when considering the impact of degree of foreign currency debt on the superiority of exchange rate regime.

By applying a small open economy model to examine the stability of output and the price level in responding to money demand, aggregate demand and supply shocks between fixed and flexible exchange rate regimes, Pilbeam (2004) found that the ranking of the exchange rate regime (fixed versus flexible) depends on the weighting that the authorities put on output and price stability, wage indexation, the type of shocks hitting the economy, structural parameters such as income elasticity of demand, the degree of openness and the elasticity of aggregate demand to fluctuations in the real exchange rate and real interest rate. A good example is that in the case of no wage indexation, a fixed exchange rate regime is better at buffering money demand shocks in terms of stability of output and price. However, in the case of no wage indexation, if the economy is hit by aggregate demand shocks then a flexible exchange rate regime is better than a fixed exchange rate regime in dealing with these shocks. In the presence of aggregate supply shocks the superior exchange rate regime depends on structural coefficients and the priority of the authorities between output and price stability. These results may be reversed for the case of wage indexation. Moreover, Pilbeam (2004) showed that if domestic goods account for a small proportion in the basket of consumption goods then a flexible regime is superior at stabilising output. Nonetheless, this study only considered the ranking of exchange rate regime in buffering domestic shocks, not external shocks.

3.3.2. Exchange rate regime classification

There are two types of exchange rate regime classifications, namely the *de jure* and *de facto* classification. A *de jure* exchange rate regime classification embodies the exchange rate policy that a country commits to applying. It was announced by the IMF until 1998 in its *Annual Report on Exchange Arrangements and Exchange Restrictions* which is based on official government statements to the IMF. This classification comprises 15 sub-categories which are grouped into three broad categories under the *de jure* classification: pegged regimes, intermediate regimes and floating exchange rate regimes.

Tavlas *et al.* (2008) indicated some advantages of the *de jure* classification which are: the coverage of economies, observations over time, updating frequency of exchange rate regime and a good indicator of future policy actions. However, the *de jure* classification has a drawback which is that the intervention actions of monetary policy-makers may be inconsistent with the policy commitment (Reinhart 2000; Frankel *et al.* 2001; Reinhart and Rogoff 2002; Levy-Yeyati and Sturzenegger 2005). Tavlas *et al.* (2008) indicated that although some countries announced a fixed exchange rate regime, the regime these countries implemented still devalued their currencies to improve competitiveness. Additionally, a flexible exchange rate regime, which is officially classified, may turn out to be a fixed exchange rate regime because the movement of the exchange rate is restricted via changes in the interest rate and foreign reserves. Hence, the *de jure* exchange rate regime classification may lead to biased results which in turn misinforms policy implications (Ahmad & Pentecost 2010).

To overcome the disadvantage of a *de jure* classification, a number of studies have introduced a *de facto* classification, as done Levy-Yeyati and Sturzenegger (2005), Ghosh *et al.* (2010), Reinhart and Rogoff (2004) and Ilzetzki *et al.* (2008). Some advantages of this can be seen as follows. Firstly, this classification is based on the actual policy rather

than the policy announcement (Levy-Yeyati & Sturzenegger 2005). In addition, a *de facto* classification has more advantages than a *de jure* classification in terms of having a wide cross-country and time series coverage (Ghosh *et al.* 2010). Although the *de facto* classification fails to distinguish whether stability is caused by the policy commitment or by the absence of a shock, it can control for the difference between the commitment and intervention by the authorities in the foreign exchange market (Chia *et al.* 2012).

Based on the *de jure* exchange rate regime, the *de facto* exchange rate regime was revised by the IMF and some authors. Firstly, the IMF revised its *de jure* regime into a *de facto* exchange rate regime in 1998 by combining information on actual data for the exchange rate, foreign reserves and monetary policy (Kokenyne *et al.* 2009). Before 2008 the IMF classified exchange rate regimes into eight categories, namely: no separate legal tender, currency union, currency board, conventional fixed, crawling peg, crawling band, independent float (which was renamed as free floating after 2008), and managed floating with no predetermined band (which was renamed as floating after 2008). From 2008 onwards, three categories were added, including stabilised arrangement, pegged exchange rate regime with a horizontal band, and other managed arrangements (Ghosh 2014)[27].

Secondly, using cluster analysis, data for the exchange rate and international reserves of all IMF-reporting countries from 1974 to 2000, Levy-Yeyati and Sturzenegger (2005) compressed exchange rate regimes into three types, these being the pegged exchange rate, intermediate exchange rate, and floating exchange rate regimes. All of these regimes were classified based on changes in the nominal exchange rate, the variability of exchange rate changes and the fluctuation of foreign reserves. In particular, these authors pointed out that the flexible exchange regime classification contains countries that have had large changes in their nominal exchange rate, substantial volatility of these changes and relatively stable

[27] See Table B1 in Appendix B for definitions of these exchange rate regimes.

fluctuations of foreign reserves. Conversely, countries with small changes in their nominal exchange rate, insignificant volatility of these changes and high fluctuation of foreign reserves are classified as a fixed exchange rate regime.

Ghosh *et al.* (1997) reclassified the *de jure* pegged regime into "infrequent" and "frequent" pegged regimes. They also grouped intermediate and floating in the same classification. Next, by using the market-determined parallel exchange rate, Reinhart and Rogoff (2004) classified exchange rate regimes into the *de facto* exchange rate regime which includes 15 categories.

Although the *de facto* regime of Reinhart and Rogoff (2004) and Levy-Yeyati and Sturzenegger (2005) has been applied in other studies, such as Chia *et al.* (2012) and Broda (2004), the *de facto* regime of the IMF has not as yet been employed to investigate the best exchange rate regime. Therefore, to confirm the accuracy of results from previous literature on the impacts of shocks on macroeconomic variables across exchange rate regimes, this study will use the *de facto* exchange rate regime of the IMF. This also helps in overcoming the drawbacks of the *de jure* classification.

3.3.3. Empirical evidence

The theory on the superiority of exchange rate regimes has also been investigated empirically. However, the results are mixed because the shocks employed are different. A good example is that by using Probit and OLS regression and *de facto* exchange rate regime classification of Ghosh *et al.* (1997) for a sample of 80 developing countries in period 1980-1989, Bleaney and Fielding (2002) found that countries with a fixed exchange rate regime experience greater fluctuations of output to TOT shock than countries with a flexible exchange rate regime. Nevertheless, Devereux (1999) discovered there is no difference in output volatility to a fiscal policy shock or supply shock between a fixed and

flexible exchange rate regime. We can see that Bleaney and Fielding considered external shock while domestic shocks were employed in the study by Devereux. Therefore, the contrary results reported in these two studies may be due to different types of shock. Elsewhere, Baxter and Stockman (1989) found that the behaviour of real macroeconomic aggregates (such as consumption, exports, imports, real exchange rate and output), except the real exchange rate, are similar between exchange rate regimes. Nonetheless, their analysis only compared the behaviour of variables between exchange rate regimes without considering the presence of any shocks which are the source of volatility of variables.

The type of shock also affects empirical findings on the superiority of exchange rate regime in stabilising the price level. Chia and Alba (2006) found that consumer prices fluctuate to a negative TOT shock by less under a fixed than under a floating exchange rate regime. Nonetheless, Kemme and Koleyni (2017) investigated the effect of external shocks, namely a US technology shock, US preference shock and US monetary shock on the price level for Mexico. They found it is higher under a fixed than under a flexible exchange rate regime. It can be seen that different types of external shock may lead to different results concerning the role of exchange rate regime in transmitting the effects of shocks on price level. Furthermore, both studies above did not mention what exchange rate regime classification such as *de jure* or *de facto* are employed and hence, the inconsistency in the results may originate from the difference in exchange rate regime classification.

Broda (2004) compared the effects of a TOT shock on real GDP, the real exchange rate and consumer prices under a fixed and a flexible exchange rate regime for 75 developing countries in the post-Bretton-Woods period (1973-1996) using a structural vector autoregressive model (SVAR). To classify the fixed and flexible exchange rate regimes he used the classification of Ghosh *et al.* (1997), which is a combination of the *de jure* and *de facto* classification. The author concluded that a flexible exchange rate regime

is superior to a fixed exchange rate regime because the fluctuation of short-run real GDP to TOT shock is smoother under a flexible than under a fixed regime. Nonetheless, this combination may lead to mixed results concerning the reaction of variables to shocks; in particular, it is difficult to distinguish whether the stability of variables in the model derives from the absence of shocks or the intervention of authorities in offsetting the shocks. In addition, the author did not conclude the superiority of exchange rate regime in terms of the stability of price level.

Unlike previous studies such as Baxter and Stockman (1989) and Flood and Rose (1995) who did not identify the source of volatility of variables, Broda isolated impacts and contribution of a real shock, namely a TOT shock. He found that the flexible exchange rate regime is better than the fixed exchange rate regime in insulating a TOT shock in terms of output stability. However, this study only focused on a specific type of shock. In theory, the superiority of the exchange rate regime depends, as emphasised previously, on the nature and type of shocks. Therefore, the unanswered question is whether a flexible exchange rate regime is better in coping with other types of shocks. The superiority of the exchange rate regime does not rely on the stability of output but also other criteria such as growth, inflation and consumption. Hence, a statement on the superiority of an exchange rate regime based on output stability does not appear to be suitable for a country pursuing, for example, an inflation targeting monetary policy.

The classification of the exchange rate regime under which an economy is operating may, therefore, produce different outcomes for key macroeconomic variables from different shocks. Unlike Broda (2004), Hoffmann (2007) separately used exchange rate regime classifications, namely *de jure* - AREAER and *de facto* - while Reinhart and Rogoff (2004) compare the reaction of variables (real GDP, the real exchange rate and trade balance) to world real interest rate shocks under a fixed and flexible exchange rate

regime[28]. By using the two classification approaches separately, the author could distinguish the adjustment of variables to shocks between a *de jure* and *de facto* exchange rate regime. In addition, by considering two types of shocks, namely world output and world real interest rate shock, Hoffman could address the question whether the superiority of an exchange rate regime (fixed or flexible) can work for any given type of shock or just a certain type of shock. However, Hoffman's study only considered the shock coming from the monetary market while other types of shocks from the goods market such as foreign demand shock and world real oil price had not been considered in his study. Therefore, we do not know whether a flexible exchange rate regime is better than the fixed exchange rate regime to cope with shocks coming from other channels.

Hoffman also found that the difference in responses of variables to world real interest rate shocks between fixed and floating exchange rate regimes under the *de jure* classification are more statistically significant than under the *de facto* classification. This implies that using different classification approaches may obtain varying conclusions on the superiority of one type of exchange rate regime. It can be seen that although various exchange rate regime approaches such as *de jure* of IMF, *de facto* of Reinhart and Rogoff (2004), *de facto* of Levy-Yeyati and Sturzenegger (2005), *de facto* of Ghosh *et al.* (1997) and *de facto* of Ilzetzki *et al.* (2008) have been used to investigate the role of the exchange rate regime in transmitting shocks to the economy, no empirical work has employed the *de facto* exchange rate regime of the IMF.

The advantage of some studies such as Hoffmann (2007) and Al-Abri (2013) is that they consider other types of shock rather than a TOT shock. Hoffmann (2007) investigated the role of the exchange rate regime in transmitting the effects of a world output shock and

[28] A comparison between a *de jure* fixed and *de jure* flexible exchange rate regime; and between *de facto* fixed and *de facto* flexible exchange rate regime.

world real interest rate shock for 42 developing countries. However, no comparison of the effects and contribution between these two types of shock had been made. Al-Abri (2013) examined the responses and variance decomposition of real output growth, inflation rate, real exchange rate and short-term interest rate of nine oil importing countries (Japan, Germany, France, Italy, South Korea, Spain, Portugal, Sweden and Finland) to a world real oil price shock under both a fixed and flexible exchange rate regime. However, the large sample in the study by Hoffmann and regional diversity in that by Al-Abri imply there is diversity in stages of development and economic characteristics which may increase the degree of heterogeneity in the sample.

Kilian (2008) indicated that an increase in the price of energy is transmitted to aggregate demand via direct and indirect channels. In terms of direct channels, increases in energy prices lead to a reduction in the consumption of energy and energy-intensive durables because consumers expect more energy efficient technologies and an increase their precautionary savings. This reduces aggregate demand. Regarding the indirect channels, the reduced spending on energy-intensive durables such as automobiles, may result in a reallocation of capital and labour as they move out of the automobile sector. This causes unemployment which reduces consumption and enlarges the influence of higher energy prices on the real economy. The indirect effect could even be greater than the direct effect. Hence, Kilian believed that the reallocation effect can bring about asymmetric effects from a positive and a negative energy price shock. This asymmetric effect is generated because the reallocation effects amplify the behaviour of macroeconomic aggregates to a positive energy price shock but weaken the responses of macroeconomic aggregates in the case of a negative energy price shock. Hence, he concluded that responses of macroeconomic aggregates are more enlarged to energy price increases than to energy price decreases.

In addition, by examining the dynamic effects of external shocks (including crude oil supply shocks and unanticipated increases in global demand for all industrial commodities and for crude oil) on the real price of oil, Kilian (2009) found that responses to a real oil price increase depends on the reasons for the oil price increase. If the increase in oil price is due to an increase in demand for crude oil then the real price of crude oil increases immediately, persistently and significantly. However, the increase in the real price of oil is delayed and prolonged in the case where there is an increase in aggregate demand for all industrial commodities. Interruptions in crude oil production lead to an insignificant and temporary increase in the real price of oil within the first year (Kilian 2009).

To restrict the degree of heterogeneity of the sample, Zhang *et al.* (2014) investigated the transmission of foreign real interest rate shocks to real GDP, real exchange rate and CPI for a sample of nine East Asian countries. They also compared the contribution of this type of shock to the fluctuation of variables between a fixed and flexible exchange rate regime. They concluded that responses of variables to the shock differ under various exchange rate regimes and, hence, this should be more carefully considered when looking for integration and coordination in monetary policy among countries with different exchange rate regimes. Given this, it is an important issue in the context of the ASEAN countries that have their own separate exchange rate regimes but want regional integration to reduce income inequality within and between them. However, this issue has not been addressed in the literature. In particular, previous studies have mainly focused on the behaviour of output, real exchange rate and price level across an exchange rate regime while not many studies have investigated the role of the exchange rate regime in transmitting the impact of shocks onto income inequality.

Chia *et al.* (2012) examined the effects of two different types of shock, namely a TOT shock and a foreign nominal interest rate shock on real GDP, real exchange rate and

output stability under fixed and flexible exchange rate regimes by SVAR and DSGE models and *de facto* exchange rate classification of Reinhart and Rogoff (2004) for 3 small Asian open economies from 1980 to 2009. They concluded that a flexible regime is better than a fixed exchange rate regime in stabilising real output. By considering both types of shocks, this study could examine separately the effects of a real and nominal shock. Nonetheless, the combination of both these shocks in one model may cause interaction between the two types of shocks. This may distort the impacts of each shock on variables across exchange rate regimes. Moreover, no comparison regarding the effect and contribution between two types of shocks under each exchange rate regime was undertaken by this study. Additionally, the superiority of exchange rate regime was only concluded based on the stability of output and no other criteria such as economic growth, real exchange rate stability or price level stability.

By considering the presence of foreign currency debt, Cook (2004) emphasised that emerging countries having a high foreign currency debt prefer a fixed exchange rate regime to a flexible exchange rate regime. Under a flexible exchange rate regime, a depreciation arising from a world real interest rate shock and foreign demand shock makes foreign-currency borrowing increase in terms of domestic currency, which then reduces domestic firms' profits. This leads to investment and output contraction.

Towbin and Weber (2013) not only considered the foreign currency debt but also pass-through to import price when investigating the impact of a TOT shock and foreign interest rate shock on output and investment under fixed and flexible exchange rate regimes for a sample of 101 countries from 1994-2007. They found that the merit of a flexible exchange rate regime in insulating shocks can be seen in countries with low foreign currency debt and high pass-through to import prices. However, for countries that have a high foreign currency debt and low pass-through to import prices, both a fixed and

flexible exchange rate regime have the same output stabilisation patterns. Hence, the traditional argument for the superiority of a flexible exchange rate regime in buffering real shocks is questionable in countries with high foreign currency debt and low pass-through to import prices. This study, however, ignored other aspects such as economic growth, real exchange rate stability and inflation stability when considering the influence of foreign currency debt on the superiority of exchange rate regime in buffering the external shocks.

To investigate why East Asian emerging countries do not desire flexible exchange rate regimes, Shi *et al.* (2015) developed a small open economy model with sticky prices and considered various types of external shocks such as foreign demand shocks, technology shocks and foreign interest rate shocks. They found that two trade features (including a high use of foreign currency in export pricing and low elasticity of substitution between domestic and foreign traded goods) prevent the adjustment of the exchange rate in responding to external shocks. Hence, a flexible exchange rate regime cannot ensure stability of the economy when it is hit by external shocks. Furthermore, they pointed out that because of high exchange rate pass-through in these countries, the exchange rate movement causes more disturbances to inflation under a flexible than a fixed regime. Therefore, the flexible exchange rate regime is not desirable in these economies or circumstances.

Rogoff *et al.* (2004) found that the advantage of the flexible exchange rate regime rises if a country is more integrated into the global capital market. Based on results for inflation, output growth and growth volatility, they concluded that developed economies with a free floating exchange rate regime grow faster without higher inflation compared to other developed economies with their own exchange rate systems. Nonetheless, developing countries with a limited degree of integration into the global capital market and fixed exchange rate regimes experience lower inflation without incurring a lower growth or

higher growth fluctuation. Emerging countries with stronger links to the global capital market than developing countries, and with fixed or less flexible exchange rate regimes, experience crises more frequently.

Aghion *et al.* (2009) discovered that a flexible exchange rate regime results in lower productivity growth in a country where financial development is low. They explained that volatility of the exchange rate under a flexible exchange rate regime results in large profit fluctuations for companies. This then reduces investment, R&D and productivity growth of the economy. They contended that countries with immature financial markets can actually benefit from a fixed exchange rate regime. Furthermore, the source of the shocks such as real shocks and financial shocks, only problems at lower levels of financial development.

Finally, some studies pointed out the link between the exchange rate regime and economic growth. A good example is that of Dornbusch (2001) who argued that lower inflation under a fixed exchange rate regime decreases the interest rate and uncertainty, and promotes investment and growth. Calvo (2001) indicated that a flexible exchange rate regime can lead to a decline in the rate of growth because a domestic currency depreciation resulting from external shocks exaggerates debt in terms of domestic currency. This may leads to bankruptcies and lower economic growth rate. However, Edwards and Levy Yeyati (2005) examined a TOT shock for 183 countries from 1974 to 2000, concluding that countries with flexible exchange rate regimes can minimise better the negative impact of such a shock on growth. However, these authors only investigated the effect of one particular shock on growth across exchange rate regimes. Therefore, it is uncertain whether the findings can be applied to any type of shock or just for the case of one particular shock.

3.4. ECONOMIC INTEGRATION AND THE EXCHANGE RATE REGIME - LITERATURE ON OPTIMUM CURRENCY AREA

This section reviews the literature on currency areas where the choice of exchange

rate regime in economic integration is examined. The basic Mundell-Fleming model which is used to analyse the effects of exogenous shocks under different exchange rate regimes is subsequently utilised to develop the theory of optimal currency areas (OCA). Kwan (1998) indicated that an OCA consists of a group of countries establishing a monetary union which applies a fixed exchange rate regime among member countries while applying a flexible regime to the rest of the world. Mundell (1961) indicated that a group of closely integrated countries will get better outcomes if they apply a fixed exchange rate regime to each other.

A country should join a monetary union if the benefits outweigh the costs of doing so. In terms of benefits, Mundell (1961) showed that a common currency lowers transaction costs and currency risk coming from currency exchange arising from exchange rate fluctuations and volatility of prices. A common currency stimulates international trade, capital flows, investment, economic growth and employment among countries joining the union. Madhur (2004) showed that trade is stimulated between countries in the OCA and, hence, the intra-regional trade volume and trade openness of a country will be greater under a fixed exchange rate regime after joining the OCA, rather than by having a flexible exchange rate regime but operating outside the OCA. However, the cost of the OCA is that members have to cede their independence on monetary and exchange rate policy in dealing with unexpected shocks (Bayoumi & Mauro 2001), causing potential problems in attaining internal (full employment and price stability) or external equilibrium (current account balance) (Kwan 1998).

Arising from the benefits and costs of forming an OCA, previous studies noted some criteria that need to be considered. First, an OCA can be established if the shocks are highly correlated among participating countries, meaning that responses of macroeconomic variables to such shocks are similar among member countries (Mundell 1961; McKinnon

1963; Kenen 1969; Tower & Willett 1970; Fleming 1971; Bayoumi & Mauro 2001). A common monetary and exchange rate policy can deal with such shocks for every member country[29]. Another criterion for establishing an OCA was indicated by Kwan (1998); that is a mechanism, such as a high degree of intra-regional economic interdependence in trade, capital and labour mobility, able to deal with macroeconomic imbalances (such as a trade imbalance) coming from asymmetric shocks. In addition, Kwan pointed out that if member countries have synchronised business cycles then a common monetary policy can help them achieve internal balance.

Lim and McAleer (2004) indicated that economic convergence is a precondition for a successful currency union. They showed that economic convergence happens when lower income countries can catch up to the high economic growth of higher income countries in the OCA. Xu *et al.* (2008) showed that economic convergence is affected by the stability of three major variables, namely per capita GDP, inflation and the exchange rate because, first, GDP per capita is a main indicator with which to measure convergence. Second, if inflation is similar between members then an OCA is feasible because member countries can conduct the same economic policies (Laabas & Limam 2002, cited in Xu et al. 2008, p.119). Finally, stability of the real exchange rate promotes trade and investment which in turns increases the chance of attaining a successful OCA (De Ocampo 2004, cited in Xu et al. 2008, p.119).

The issue of an OCA has been investigated in some regions such as the Common Market for Eastern and Southern Africa (COSMESA), East Asia and ASEAN. A good example is the study by Njoroge *et al.* (2011) who examined whether it is feasible to have a monetary union for COMESA, by testing for the degree of symmetry in business cycles

[29] The exchange rate policy is all currencies are fixed to one another.

from 1990-2009. They compared the responses of output and consumer price to internal (demand and supply) and external (exchange rate) shocks between countries in COMESA by using a VAR model. The authors found that in terms of output volatility, a monetary union for this region is feasible because the responses of output of each member country to shocks are symmetric.

In addition, by using a VAR model to investigate the symmetry of macroeconomic disturbances in East Asia, some studies found that it is impossible for this area to have a common currency because the responses to shocks by member countries are quite dissimilar due to differences in economic structure and stages of development. Nevertheless, small sub-regions in East Asia satisfy the prerequisite for an OCA (Bayoumi & Eichengreen 1994; Ling 2001; Kim 2007; Lee & Azali 2009; Nguyen 2010). A good example is the analysis by Kim (2007) who examined whether it was possible for an East Asian currency union between the ASEAN 4 (Malaysia, Indonesia, Singapore and the Philippines), China, Japan and South Korea. Kim found that the macroeconomic shocks affecting these countries are heterogeneous. Moreover, the macroeconomic responses to shocks are asymmetric. Hence, the results did not favour a monetary currency union among ASEAN countries or Northeast Asian countries (China, Japan and South Korea). Nonetheless, the outcome supports a currency union between China and Hong Kong. However, this study did not investigate the responses of variables to shocks under different exchange rate regimes and therefore, the symmetry responses may originate from the difference in exchange rate regime that each country applied. These studies, however, did not take into account the role of the exchange rate regime in investigating the symmetry/asymmetry in responses of variables to shocks.

Nguyen (2010) examined the feasibility and desirability of forming an optimal currency area for East Asia, including the ASEAN 5, Japan, South Korea, China, Hong

Kong and Taiwan by checking the symmetry of shocks[30]. He found that in comparison to Europe, East Asia is less suited to a currency area because shocks in East Asia are more asymmetric than that of Europe. Nevertheless, a subgroup of East Asia including South Korea, Hong Kong, Singapore, Malaysia, Indonesia and Thailand, is more plausible for a currency union because the shocks are quite synchronised. Furthermore, he concluded that if output volatility is driven mostly by regional shocks then a common currency is desirable. However, a common currency might not be wanted if volatility is affected mainly by country-specific shocks because a common policy is not enough to deal with asymmetric shocks and so a common currency will be costly.

The idea of a single currency area for ASEAN was also considered in the study by Bunyaratavej and Hahn (2003). They showed that a common currency can make ASEAN countries resilient to future currency shocks and stability of exchange rates. They also indicated that a common currency plays a role in eliminating exchange rate risks which in turn creates a better trade and investment climate for ASEAN. Some studies indicated that the differential level of economic development of ASEAN is an obstacle to forming a common currency because income disparities can result in political and economic instability for the region (Bunyaratavej & Hahn 2003; Madhur 2004; Ramayandi 2005).

By considering both types of β and σ convergences, Bunyaratavej and Hahn (2003) found that it was impossible for ASEAN to form a currency union because, firstly, their results for β convergence showed that lower income ASEAN countries did not seem to grow faster than the higher income countries[31]. Moreover, the result for σ convergence indicates a high degree of GDP per capita divergence was evident among these countries[32].

[30] ASEAN 5 includes Singapore, Thailand, Malaysia, Indonesia and the Philippines.
[31] σ convergences is used to measure the convergence in GDP per capita where β convergence measures convergence in growth rates.
[32] A similar conclusion can be found in the following studies: (Bayoumi *et al.* 2000; Bayoumi & Mauro 2001; Madhur 2004; Ramayandi 2005).

They concluded that low income ASEAN countries need many decades to catch up with average income per capita. Nonetheless, they showed that sub-groups such as the ASEAN6 could be ideal for a common currency[33].

While most studies explored separately the convergence and symmetry of shocks, Xu *et al.* (2008) conducted a test for both economic convergence and symmetry of shocks to investigate whether it is feasible for the ASEAN 5 (Singapore, Thailand, Malaysia, the Philippines and Indonesia) or a subgroup to have a common currency. In this study the nominal exchange rate, the real GDP growth rate and inflation were all used to test for economic convergence. The authors employed three types of shocks, namely domestic demand shocks, domestic supply shocks, external shocks and a SVAR model to test for the symmetry of shocks[34]. For the first precondition-economic convergence, the findings indicated that there are convergences in the nominal exchange rate and inflation of the ASEAN3 sub-group (Singapore, Malaysia and Thailand). However, there was no convergence found in terms of real GDP for the ASEAN-5

For the second precondition, the authors examined the correlation of growth and inflation, correlation of demand and supply shocks and the correlation of the responses of variables to shocks. The findings indicated there is a high degree of correlation of growth and inflation in the ASEAN-5. Moreover, these five countries also exhibited a positive correlation in terms of external shocks. Nonetheless, only Singapore, Malaysia and Thailand had correlations to supply and demand shocks. Hence, based on the results of both criteria, they concluded that it is reasonable for these countries, but not the ASEAN-5, to be a common currency area.

Xu *et al.* (2008) also pointed out that it is not easy to establish a currency union for

[33] ASEAN6 includes Brunei, Indonesia, the Philippines, Malaysia, Singapore and Thailand.
[34] The authors state that the correlation of external shocks should be taken into account because of their openness, which makes ASEAN countries vulnerable to external shocks.

all ten ASEAN countries primarily because of the large gap in economic development (GDP per capita). In particular, Singapore, Malaysia, Thailand and Brunei have a much higher GDP per capita than Cambodia, Lao PDR, Myanmar and Vietnam (CLMV). In addition, these countries have very diverse exchange rate regimes ranging from a hard peg to a freely floating regime. It is difficult for the 10 ASEAN countries to agree on a common exchange rate regime as well as for lower income countries to catch up to higher income countries. One important dimension that is absent from this study is that the exchange rate regime plays a role in the behaviour of macroeconomic variables to shocks and, hence, at different stages of development, members of the AEC are likely to respond differently to external shocks. If they should not fix their exchange rates to each other, they may have to pursue their own optimal exchange rate regime given these shocks and minimise the effect on output variability and economic growth. By doing so they would then in aggregate reduce the income gap. Nevertheless, no recommendations on what is the best exchange rate regime for each ASEAN country to narrow the income gap were made by this study. Furthermore, this study was lack of direction for ASEAN members to achieve internal income equality and, in particular, income equality across members.

3.5. THE RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND THE INCOME GAP

3.5.1. Relationship between macroeconomic variables and between-countries income gap

The income gap between countries has been considered in the literature in terms of income convergence or income divergence. Income convergence occurs when income gap falls, and income divergence means an increase in the income gap (Svedberg 2004). The "catch-up effect" theory assumes that the income per capita between lower and higher income countries will converge when the lower income country grows faster than the

higher-income country.

According to Park (2000) income convergence means that the gap in per capita incomes among nations narrows over time. He also indicated that to attain convergence, poorer countries need to grow faster than richer ones. The capital flows from higher income countries to lower income countries because of diminishing marginal returns to capital and the gap in relative endowments of capital between the rich and the poor countries. Therefore, the capital flow plays a role in increasing growth in lower income countries and then reducing the income gap. In the literature, economic growth is affected by shocks and the exchange rate regime plays a role in transmitting the effect of shocks to economic growth. Hence, this study did not indicate which exchange rate regime poor countries can implement to reduce the income gap more quickly.

ECB (2015) indicated that macroeconomic stability is the first condition for sustainable real convergence, which is when GDP per capita of poorer countries catches up GDP per capita of richer countries. Schiavo (2008) pointed out that income convergence across countries relates to low volatility of the real exchange rate while income divergence is associated with high instability of the real exchange rate. Nonetheless, these studies only showed the correlation between macroeconomic stability and between-countries income gap. These studies did not find a strong relationship between the income gap and macroeconomic instability originating from shocks under different exchange rate regimes.

3.5.2. Relationship between macroeconomic variables and within-country income gap

The relationship between economic growth and within-country income gap has been investigated in the literature. Kuznets (1955) hypothesised a nonlinear relationship between economic development and income inequality. In particular, income inequality is

higher at the premature stage of economic development; however, it is lower at the developed economic stage. This implies that income inequality increases during the rapid growth phase and may come down at higher levels of economic development. Kuznets (1955) hypotheses have been tested and analysed by many empirical studies which found that the stage of development determines the relationship between inequality and economic growth. Persson and Tabellini (1994) and Alesina and Perotti (1996) found a negative relationship between income inquality and economic growth. In particular, income inequality hinders economic growth in low-income countries

Nevertheless, the link between income inequality and economic growth has been found to be positive. Li and Zou (1998) and Forbes (2000) showed that income equality lowers economic growth in high income countries. Shin (2012) explained that income redistribution from the rich to the poor in these countries discourages the rich from working harder or aiming to achieve more wealth. Additionally, the rich in these countries have a higher rate of saving than the poor and hence the saving rate of the economy falls when there is redistribution in favour of the latter. This reduces investment and economic growth.

Stiglitz (2012) pointed out that output volatility may have adverse impacts on income inequality via direct and indirect channels. The direct channel is that output volatility causes unemployment in which the least skilled workers are more negatively affected. This is because firms prefer to retain skilled personnel to reduce training costs in periods of economic downturn. This leads to income disparity between skilled and unskilled workers. In terms of the indirect channel, Stiglitz argued that entrepreneurs need high-risk premiums in a highly unstable economy, and so they have to lower wages or increase profits to attain a similar level of investment on average. This leads to income disparity between entrepreneurs and workers. Alternatively, volatility produces a lower level of investment,

which then compromises economic growth, resulting in less being spent on public education and social welfare policy, which is important to the poor.

Bulíř (2001) demonstrated that inflation is a factor affecting income inequality. There are two types of workers, those who work with a nominal wage contract and those who work with an inflation-adjusted wage contract. The inflation protected wage group can get higher income relative to the unprotected group. As a consequence this widens the income inequality. He found that the current level of income inequality, as measured by the Gini coefficient, is affected by past inflation. He pointed out that price stability has a nonlinear positive impact on income distribution. In particular, income inequality reduces remarkably if inflation decreases from hyperinflation levels. However, income inequality decreases insignificantly if inflation declines from an already low level. This study, however, did not consider the effects of shocks that are one of the factors causing inflation, on income inequality. In addition, the effects of inflation on income inequality were not investigated under different exchange rate regimes, to better understand which exchange rate regime causes greater or less income inequality.

Within-country income inequality is also affected by the real exchange rate. Guillaumont Jeanneney and Hua (2001) investigated the impact of the real exchange rate on income per capita inequality between urban and rural areas in China. They found that rural households consume a greater share of non-tradable goods whereas more tradable goods are consumed by urban families. A real depreciation of the domestic currency increases the price of tradable goods. As a result the consumer price in the city rises faster than in the country. This narrows the income gap between urban and rural areas. Moosa (2005) showed that the "real exchange rate may be a proxy for the distribution of income among workers in the traded and non-traded goods sectors" and hence the real exchange rate contributes to the fluctuation of income inequality. This occurs via the transmission of

real exchange rate changes to the price of tradable and non-tradable goods.

3.6. RESEARCH GAP IN THE LITERATURE REVIEW

A number of research gaps have been identified in the literature and these are explained in more detail here. Firstly, ASEAN countries are now indeed linked to the world economy via a variety of channels such as the goods market and financial market, resulting in these countries responding differently to shocks. Most studies considered just one type of shock such as a TOT shock, world real oil price shock or real interest rate shock. Therefore, the question is: can the findings on the superiority of an exchange rate regime be implied for one specific type of shock or should this be for all types of shock? The literature assumes that the response of the economy may differ depending on the nature of the shock. However, there have been scant empirical studies considering various types of shocks, especially the inclusion of a foreign trade shock, across exchange rate regimes. Therefore, a comparison of the effects and contribution of different shocks on variables under different exchange rate regimes has not been conducted. To fill this gap in our knowledge, this study will take into account various types of shock coming from different channels such as a foreign demand shock, world real oil price shock, and foreign real interest rate shock. This study also compares the effects and contribution of shocks on variables according to each type of exchange rate regime.

Second, the role of exchange rate regimes on the behaviour of macroeconomic variables arising from exogenous shocks has been examined in the literature. The relationship between macroeconomic variables and the income gap (between and within countries) has been separately investigated. However, the importance of the exchange rate regime in transmitting the effects of exogenous shocks to income gaps (between and within countries) has not yet been analysed. This is important where countries wish to engage in closer economic integration and recognise the importance of closing income and

development gaps such as within the context of ASEAN.

Third, any investigation of the impact of external shocks on ASEAN members has been limited to Singapore, Thailand, Malaysia, the Philippines and Indonesia. No study has covered this issue for all ten ASEAN countries as yet. Additionally, these studies have not considered the effects of external shocks on the income gap (between and within ASEAN countries) although Masron and Yusop (2008) found that external shocks simply increased the income gap between ASEAN countries. Furthermore, they did not incorporate the importance of different exchange rate regimes when investigating the impacts of external shocks on ASEAN member country economies. Moreover, the superiority of an exchange rate regime was concluded based on some criteria, these being output stability, price level stability, consumption stability and economic growth. However, an additional policy priority such as income equality that ASEAN countries are seeking to achieve has not been addressed in previous studies.

Finally, as mentioned by Kim and Papi (2005), a *de facto* exchange rate regime is preferable to a *de jure* exchange rate regime and there is competition among methodologies in classifying a *de facto* exchange rate regime. Previous studies have employed some classifications of the exchange rate regime such as the *de facto* of Levy-Yeyati and Sturzenegger (2005), the *de facto* of Ilzetzki *et al.* (2008) and the *de facto* of Reinhart and Rogoff (2004). Although the IMF has reclassified the *de jure* to the *de facto* exchange rate regime since 1999, this new classification has not been employed in investigating the superiority of different exchange rate regimes in terms of buffering the effects of exogenous shocks. Using a different methodology to classify different exchange rate regimes may lead to varying results in regard to the superiority of an exchange rate regime. Hence, this study will apply the IMF's new *de facto* classification to examine the responses of macroeconomic variables to shocks across different exchange rate regimes.

By doing so, this study provides additional empirical evidence on the merits and problems associated with different exchange rate regimes.

3.7. CONCLUDING REMARKS

This chapter has reviewed the literature relating to the superiority of fixed or flexible exchange rate regimes based on comparing the responses of macroeconomic variables to different exogenous shocks. It can be seen from the literature that the optimal exchange rate regime depends on the type of shock, the policy priority for the choice of optimal exchange rate regime (e.g. output, price, exchange rate, trade balance and income gap volatility) and the country's characteristics. The superiority of an exchange rate regime has also been scrutinised using OCA theory which is linked to the issue of regional integration in the context of ASEAN countries. This chapter has also reviewed the literature on the relationship between macroeconomic variables and the income gap (between and within countries). These links suggest the role of the exchange rate regime on the behaviour of the income gaps.

However, from the literature review it can be seen that no study to date has investigated the effect of the exchange rate regime on the income gap. Additionally, the effects and contribution of external shocks on ASEAN economies and their income gaps under a fixed and a flexible exchange rate regime have not to date been investigated. Moreover, no empirical study has investigated the transmission of foreign trade shocks to ten ASEAN countries as a group through the exchange rate regime channel.

There are two types of exchange rate regime classifications, namely *de jure* and *de facto* exchange rate regimes. The *de jure* classification may lead to biased results because there is inconsistency between the intervention actions of monetary policy-makers and the policy commitment. Although the *de facto* classification fails to distinguish whether the

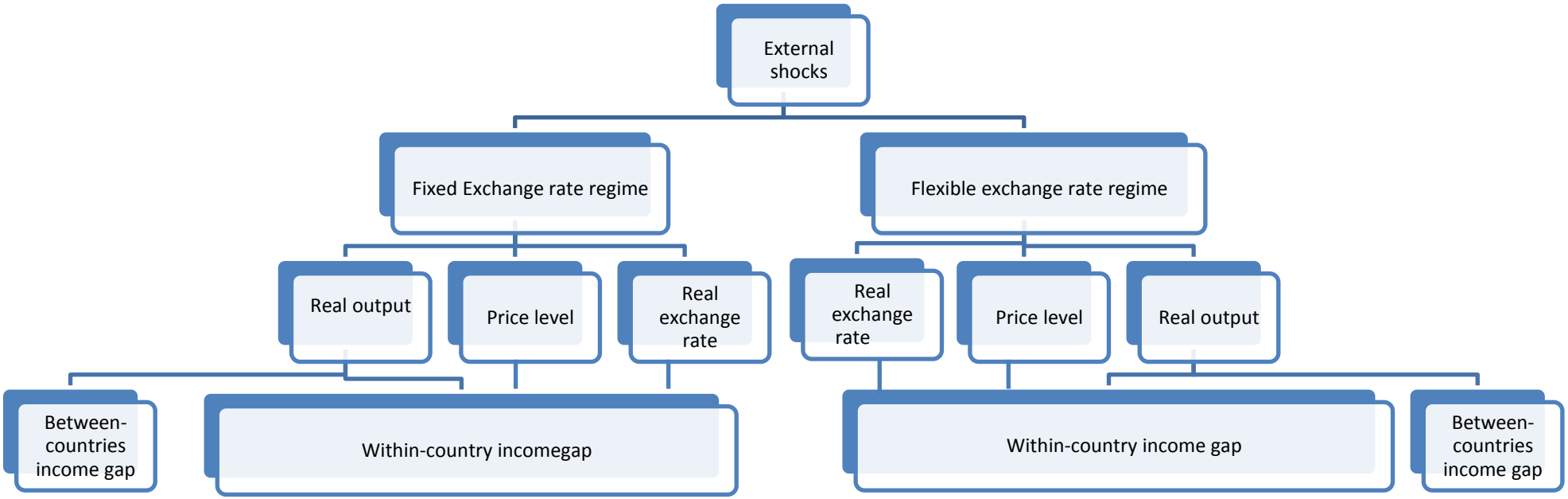
stability of the exchange rate comes from the policy commitment or from the absence of shocks, it can control for the difference between the commitment and the intervention of authorities in the foreign exchange market.

Although the IMF reclassified the *de jure* regime to a *de facto* regime in 1998, the latter has not been applied previously in studies on the choice of exchange rate regime. Therefore, this is the first study to do so for the ASEAN nations, in order to understand which is the best exchange rate regime that can minimise the negative effects of external shocks on real GDP, the real exchange rate, price level and between-countries and within-country income gap for ASEAN countries?

Finally, to address these research gaps this study will apply a panel vector autogressive model and the IMF's *de facto* exchange rate regime to examine the responses of macroeconomic variables such as output, the real exchange rate, inflation and income gap (between and within nations) to external shocks under fixed and flexible exchange rate regimes for ASEAN member countries. To investigate the contribution of external shocks on the volatility of variables under a fixed and a flexible exchange rate regime, this method is also used to generate variance decomposition of variables under a fixed and a flexible exchange rate regime. The specification of the panel vector autogressive model will be presented in the next chapter.

This study is conducted to fill the research gaps under the following framework:

FRAMEWORK OF THE STUDY



CHAPTER 4: DATA AND METHODOLOGY

4.1. INTRODUCTION

As stated in the previous chapter, this study will fill the knowledge gap in the literature by investigating and comparing the impacts and contribution of various types of external shocks on output, price level, real exchange rate, between-countries and within-country income gap under fixed and flexible exchange rate regimes. As well, this study compares between the effects and contribution of these shocks on macroeconomic variables under each exchange rate regime.

We consider various external shocks such as a world real oil price shock, foreign demand shock and foreign real interest rate shock. There are some reasons for choosing the case of oil price shocks. Firstly, Basnet and Upadhyaya (2015) indicated that the change in oil price affects macroeconomic variables via its impacts on supply channels such as production, manufacturing and distribution cost. An increase in the oil price can result in contraction in output and aggregate supply due to the increase in production costs. Furthermore, an increase in the oil price leads to higher costs for consumption and expenditure by households, which subsequently reduces wealth. As a result, less prosperity reduces expenditure and demand for goods and services. They also pointed out that oil is an input for production and the distribution of goods and services and, hence, an increase in the oil price leads to higher price levels and inflation. Moreover, a change in the oil price affects the exchange rate and, in particular, a higher oil price leads to an appreciation of an oil-exporting country's currency due to the increase in demand for that currency.

We decide to also choose a foreign demand shock because of the following reasons. Firstly, Lindert and Pugel (1996) indicate that an international trade shock is the major

form of external shocks[35]. They indicate that it is actually a movement in an economy's exports or imports. Furthermore, it was indicated in Chapter 2 that international trade plays an important role in the economic growth of ASEAN countries because most ASEAN countries are export-led growth oriented and have high trade openness. In addition, foreign demand shocks are considered to be common shocks that countries experience (Dollar & Kraay 2004). Finally, it was a major channel that transmitted the impact of the GFC into the ASEAN countries' economies (Sangaré 2016).

Finally, we investigate the effects of a foreign real interest rate shock because it is one of the most crucial mechanisms by which international shocks are conveyed from advanced economies to small open economies (Zhang *et al.* 2014). The importance of a foreign real interest rate shock to ASEAN countries is increasing because these nations are increasingly better integrated into the world's financial markets and receive rising capital flows.

The choice of other variables, namely real output, price level, real exchange rate, between-countries and within-country income gap occur for the following reasons. Firstly, the real exchange rate is chosen because any fluctuation in the real exchange rate will be treated as a misalignment, which can trigger macroeconomic instability. Secondly, Little (1993) points out that instability in the real exchange rate can seriously undermine growth and lead to uncertainty resulting in adverse effects on investment. Price and output volatility to foreign demand shocks are also examined because, as Serra and Stiglitz (2008) indicate, output growth and price stability are key indicators of macroeconomic stability. Finally, we examine the behaviour of the between-countries and within-country income gap because it is particularly important for the ASEAN countries as they seek to achieve closer integration between their economies.

[35] They define international trade shocks as arising from exogenous changes in the country's current account

This chapter aims to illustrate the nature of the data used in this study, to test the stationarity of the dataset and the methodology employed. Moreover, this chapter constructs two empirical models for ASEAN countries, which are presented in Section 4.2. The first model - for the between-countries income gap - is established for evaluating the effects and contributions of external shocks on variations of real GDP, real exchange rate, the price level and income gap across ASEAN countries fixed and flexible exchange rate regimes. The second model - for the within-country income gap - will examine the impacts and contribution of external shocks on the behaviour of real GDP, real exchange rate and price level and income gap within ASEAN countries under fixed and flexible exchange rate regimes. Importantly, we aim to separately investigate the responses of the income gap across countries and within-countries to external shocks under fixed and flexible exchange rate regimes. This is done because to the best of our knowledge no existing theory has yet considered the relationship between between-countries income gap and within-countries income gap. Hence, we do not consider the feedback effect from changes and interaction of between-countries and within-country income gaps. Section 4.3 presents the data collection and, tests for stationarity and cointegration. To examine the effects and contribution made by external shocks to the fluctuation of variables, this chapter will apply a structural vector autoregressive model (SVAR), which is presented in Section 4.4. Finally, conclusions will be presented in Section 4.5.

4.2. EMPIRICAL MODEL FOR THE ASEAN COUNTRIES

This section outlines two empirical models, namely the model for the between-countries income gap and the model for the within-country income gap for ASEAN countries. In both models, we highlight the relationship between the key variables, these being external shock (EX), real output (y), price level (P), real exchange rate (e) between-countries income gap (BI) and within-country gap (WI) under fixed and flexible exchange

rate regimes. Broda (2004) points out that, in theory, small countries are price takers on global markets. ASEAN countries are predominantly small economies and, hence, this study assumes that external shocks are not affected by fluctuations occurring in individual ASEAN economies. In the models for ASEAN countries, external shocks are not affected by their output, price level, real exchange rate and income gap (between and within countries).

4.2.1. Output equation

Output responds differently to external shocks across different exchange rate regimes. A good example is that of Lindert and Pugel (1996) who showed that a decline in foreign demand reduces real domestic output. They state that a negative foreign demand shock results in domestic currency depreciation and, hence, under a fixed exchange rate regime, the central bank will intervene by selling foreign exchange reserves and buying domestic currency. They indicated that if this intervention is not supported by sterilisation then the money supply will decline, and real national product will further fall. Nonetheless, under a floating exchange rate regime, a government does not intervene, and this will improve domestic competitiveness which then leads to: firstly, an increase in exports; and secondly, a decrease in imports. As a result, economic growth and income will improve.

In terms of another external shock, namely a world interest rate shock, Hoffmann (2007) pointed out that a rising world real interest rate leads to a depreciation of the domestic real exchange rate. Under a floating exchange rate regime, the real depreciation results from nominal depreciation which leads to the falls in the relative price of domestic to foreign goods in terms of domestic currency. This helps to mitigate the negative impact of the world output shock and stabilises domestic economy output. However, under a fixed exchange rate regime, the real depreciation is caused by deflation, which results in adjustments in the real economy. The real depreciation of domestic currency under a fixed

regime can be explained whereby the increase in world real interest rate causes capital outflow. This leads to an increase in the nominal exchange rate. Therefore, a country's central bank intervenes to buy the domestic currency with foreign reserves, the domestic money supply falls and this puts downward pressure on demand for output and then the price. As a result the real exchange rate has depreciated.

To differentiate the behaviour of output to external shocks, inflation and the real exchange rate between a fixed and a flexible exchange rate regime, variables in the equation for economic growth will be interacted with dummy variables for the fix and the flexible exchange rate regime. The equation for the behaviour of output of the model for between-countries income gap is:

$$\Delta y = a_{11}\Delta EX + a_{12}\Delta P + a_{13}\Delta e_r \quad (4.1)$$

where Δy is real GDP growth, ΔEX is an external shock, ΔP is the change in price level, Δe_r is change in the real exchange rate.

The output equation of the model for within-country income gap is similar to that concerning the model for between-countries income gap. However, as indicated in Chapter 3, it is evident that economic growth depends on within-country income inequality. In particular, changes in income inequality can have a negative or positive impact on economic growth depending on the development stage of a country. Hence, the equation for output behaviour concerning the model for within-country income gap is as follows:

$$\Delta y = a_{11}\Delta EX + a_{12}\Delta P + a_{13}\Delta e_r + a_{14}\Delta WI \quad (4.1)'$$

where Δy is real GDP growth, ΔEX is an external shock, ΔP is the change in price level, Δe_r is change in the real exchange rate, ΔWI is the change in within-country income gap.

4.2.2. Price level equation

External shocks have different effects on the price level under fixed and flexible

exchange rate regimes. For example, Lindert and Pugel (1996) argue that under a fixed exchange rate regime, a central bank has to buy domestic currency to prevent depreciation, which is a consequence of a negative foreign demand shock. They show that this intervention results in a decline in the domestic money supply, which in turn lowers the price level. Nonetheless, under a floating exchange rate regime, a depreciation of the domestic currency increases the domestic price level due to the rise in price of imports in terms of domestic currency.

The price level also depends on output. In particular, a higher real GDP growth can increase the demand for transactions purposes and this may lead to higher price level. The price level is also affected by changes in the real exchange rate. An appreciation of the domestic currency leads to an increase in imports and a decrease in exports. As a result, the current account deteriorates and domestic aggregate demand falls. This plays a role in reducing the price level.

The equation for the price level for both models, between-countries income gap and within-country income gap, is illustrated as follows:

$$\Delta P = \mathrm{a}_{21}\Delta EX + \mathrm{a}_{22}\Delta y + \mathrm{a}_{21}\Delta e_r \qquad (4.2)$$

where ΔP is the change in price level, ΔEX is an external shock, Δy is real GDP growth, Δe_r is the change in the real exchange rate.

4.2.3. Real exchange rate equation

The behaviour of real exchange rate under a fixed and a flexible exchange rate regime depends on external shocks. A good example is that Lindert and Pugel (1996) argued that a decline in foreign demand for exports can deteriorate the current account which may worsen the overall balance[36]. There is no change in the nominal exchange rate under a fixed exchange rate regime as the central bank will intervene by buying domestic

[36] They assume that there is no change in the capital account.

currency on the foreign exchange market. This intervention decreases the money supply and lowers the price level. A consequence of this is that the real exchange rate increases. Similarly, under a floating exchange rate regime, deterioration in the overall trade balance arising from a negative foreign demand shock leads to a depreciation of the nominal and real exchange rate. However, the response of the real exchange rate to the shock is stronger and faster under a floating than under the fixed exchange rate regime because the nominal exchange rate can adjust immediately while prices tend to adjust more slowly.

The mechanism that output affects the real exchange rate is different across the exchange rate regimes. An increase in domestic output leads to an increase in imports and a deterioration in the trade balance which then causes a nominal depreciation. If the central bank does not intervene in the foreign exchange market such as under a floating exchange rate regime then the nominal depreciation results in a real domestic currency depreciation. Nonetheless, if the central bank intervenes to maintain a fixed exchange rate by buying domestic currency, then the intervention may lead to a fall in the price level in the case of no sterilisation. Consequently, this brings about the real exchange rate depreciation.

The real exchange rate depends on the price level. Under a fixed exchange rate regime the real exchange rate is affected by fluctuations of prices whereas both the domestic price level and nominal exchange rate play a role in the case of a flexible exchange rate regime[37].

Therefore, the equation for the real exchange rate in the model for between-countries income gap can be written as follows:

$$\Delta e_r = a_{31}\,\Delta EX + a_{32}\,\Delta y + a_{33}\Delta P \qquad (4.3)$$

where Δe_r is the change in the real exchange rate, ΔEX is an external shock, Δy is real GDP growth, ΔP is the change in price level.

[37] This assumes that no change will occur in the foreign price level.

The real exchange rate equation developed in the model for within-country income gap is similar to that for the between-countries income gap. Nonetheless, Min *et al.* (2015) and Garcia (1999) find that income inequality affects the real exchange rate (see the discussion in Section 3.5) and hence the equation for the within-country income gap model is:

$$\Delta e_r = a_{31}\,\Delta EX + a_{32}\,\Delta y + a_{33}\Delta P + a_{34}\,\Delta WI \qquad (4.3)'$$

where Δe_r is the change in the real exchange rate, ΔEX is an external shock, Δy is real GDP growth, ΔP is the change in price level, ΔWI is the change in within-country income gap.

4.2.4. Income gap equation

4.2.4.1. Between-countries income gap equation

Section 3.5 indicated that economic growth plays an important role in the income gap between countries. In particular, if the economic growth of poorer countries is higher than that of richer countries then this income gap will shrink. Therefore, external shocks may affect the income gap between ASEAN countries via its impacts on output. A good example of this is when a negative export demand shock results in a decrease in export revenue and then economic growth and income, which in turns has an impact on the income gap between ASEAN countries. Under different exchange rate regimes, external shocks result in varied responses of macroeconomic variables (see Section 3.3) which then may lead to changes in between-countries income gap. For instance as stated in Section 4.2.1, Lindert and Pugel (1996) opine that the recovery of output to a negative foreign demand shock is quicker under a flexible rather than a fixed exchange rate regime. Therefore, a lower income country which is hit by a foreign demand shock can recover more quickly under a flexible regime. This means a lower income country can reduce the income gap quickly if it applies a flexible exchange rate regime.

Another example is that as indicated in Section 4.2.2 and Section 4.2.3, where a negative foreign demand shock leads to different impacts on the price level and the real exchange rate under a flexible as compared to a fixed exchange rate regime. As a consequence, the difference in the behaviour of the price level and real exchange rate to the shocks between the fixed and the flexible exchange rate regime leads to differences in the behaviour of exports, imports, investment and per capita income. This situation thereby results in differences when changes occur in the between-countries income gap scenario between the fixed and flexible exchange rate regimes[38].

The estimated equation of the between-countries income gap is given by:

$$IG = a_{41}\Delta EX + a_{42}\Delta y + a_{43}\Delta P + a_{42}\Delta e_r \quad (4.4)$$

where IG is the between-countries income gap, ΔEX is an external shock, Δy is real GDP growth, ΔP is the change in price level, Δe_r is change in the real exchange rate.

4.2.4.2. Within-country income gap equation

External shocks may play a role in the context of within-country income inequality. Sumarto and Moselle (2015) indicated that the shock hurts poor households because they have little in the way of savings and this puts them at great risk of falling into poverty due to the economic shocks.

Aizenman and Pinto (2005) pointed out that the source (exogenous, semi-exogenous such as TOT shock and domestic) and nature of shock affects within-country income disparity via different channels and intensity. They exampled that through the labour income channel, rural population tends to be affected by a decrease in commodity price shock and natural disasters. Nevertheless, urban population is more affected by financial shock via falls in asset prices. They also showed that the effects of macroeconomic volatility and shocks on income inequality depend on initial conditions such as the

[38] The income gap in this study refers to the difference in income per capita between countries.

exchange rate regime, degree of international integration such as trade openness, access to international capital markets and type of shock. However, this study did not show how shocks affect the within-country income gap under different exchange rate regimes.

Laursen and Mahajan (2005) indicated that the lower income group may be more vulnerable to shocks than the higher-income group, mainly because the lower income group includes unskilled workers whose incomes mainly come from labour earnings and government transfers. Therefore, a negative foreign demand shock results in a decrease in export and government revenue which in turn may reduce government subsidies for the poor. Moreover, their lower level of assets and limited access to the financial market do not shield workers against employment shocks which are caused by a decline in export demand by other countries. As a result, a negative foreign demand shock can cause greater income inequality. However, this study did not discuss the case that a negative foreign demand shock may generate more income equality. It is because a decline in exports may disproportionately impact skilled workers and profits for entrepreneurs and hence, this could reduce income inequality.

Other studies point out that inequality depends on economic growth, openness, real exchange rate and price stability. A good example is that Aizenman and Pinto (2005) showed that inflation and the real exchange rate are the main variables affecting income inequality because they affect the real wage, capital gain/loss, income transfers and employment among different income groups and economic sectors. In addition, as mentioned in chapter 3 that more non-tradable goods are consumed by rural households compared with urban households and therefore, devaluation make consumer prices increase more sharply in urban area than in rural area. This reduces income inequality between urban and rural area.

The model for within-country income gap is:

$$\Delta WI = a_{41}\Delta EX + a_{42}\Delta y + a_{43}\Delta P + a_{42}\Delta e_r \quad (4.4)'$$

where ΔWI is within-country income gap, ΔEX is an external shock, Δy is real GDP growth, ΔP is the change in price level, Δe_r is change in the real exchange rate.

4.3. DATA AND STABILITY TEST

4.3.1. Data source and definition

To estimate the empirical model, 160 annual observations are collected from 10 ASEAN countries from 1999 to 2014. As stated in Chapter 2, ASEAN was formed in 1967 by Singapore, Malaysia, the Philippines, Indonesia and Thailand. It was then further expanded to other countries, namely Brunei (1984), Vietnam (1995), Laos (1997), Cambodia (1999) and Myanmar (1997). Due to the accession of Cambodia in 1999, this year is chosen for the starting year of the dataset. Moreover, it is the year in which the IMF began to release its *de facto* exchange rate regime classification which is used for the conduct of the empirical analysis of this study. The year 2014 was chosen as the end of the data period because at the time we collected data, data for Cambodia, Lao PDR, Myanmar and Vietnam after 2014 were not available.

Variables used for the empirical analysis are external shocks (including foreign demand, world real oil price and foreign real interest rate), real output, the price level, real exchange rate, exchange rate regime, between-countries income gap and within-country income gap. Foreign demand is proxied by world real output. For the oil price, we follow Al-Abri (2013), who calculated the world real oil price by employing the average of three spot prices, namely Dated Brent, West Texas Intermediate, and the Dubai Fateh. These were measured by USD per barrel, then converted into the local currency and adjusted by CPI. The data are collected from World economic Outlook (WEO) of International Monetary Fund (IMF).

For the world real interest rate, we follow Hoffmann (2007) and Zhang *et al.* (2014) who calculated the average world real interest rate by GDP weighted sums of the G7 countries' real interest rates. The real interest rate of each G7 country is the short-term nominal interest rate, adjusted for inflation expectations. The data are taken from the OECD website.

Real output-GDP, real exchange rate-ER, consumer price index-CPI, between-countries income gap (BI) and within-country income gap (WI) are collected from the IMF, World Bank, UNDP and ADB. The details of the sources and measurement are presented in Table C3 in Appendix C. Real GDP, the real exchange rate and between-countries income gap are calculated by the following formulas:

$$Real\ GDP = \frac{Nominal\ GDP}{CPI} \tag{4.5}$$

where real GDP is real gross domestic product; nominal GDP is nominal gross domestic product; CPI is the consumer price index.

The real exchange rate is calculated as: $$RER = e\frac{CPI^*}{CPI} \tag{4.6}$$

where RER is the real exchange rate to the United States dollar; e is the nominal exchange rate to the United States dollar[39] which is expressed as units of domestic currency per one unit of the US's currency; CPI^* is the consumer price index of the United States; and CPI is the consumer price index of the ASEAN countries.

There are two main types of real convergence, specifically beta (β) convergence and sigma (σ) convergence. Lim and McAleer (2004) indicated that σ convergence is a more accurate index for measuring income convergence between countries while β convergence is just a necessary, not a sufficient, condition for reducing the income gap over time. In

39 The nominal exchange rate to the USD is employed because the USD accounts for 80-95% of the basket of foreign currencies in the foreign reserves of ASEAN countries (Reinhart and Rogoff 2004; Ilzetzki et al. 2009, cited in Allegret *et al.* 2012).

addition, Kaitila (2013) showed that sigma convergence is a simple and unambiguous measurement for calculating convergence. Moreover, he indicates that it is not linked to any specific growth model. For this reason this study will apply the formula of sigma convergence in output series that is applied by Lim and McAleer (2004) to calculate the income gap between countries[40].

$$IG_{it} = lny_{it} - lny^*_t \quad (4.7)$$

where IG_{it} is the income gap of country i at time t; y_{it} is real GDP per capita based on purchasing power parity (PPP) for country i at time t; y_t^* is the average real GDP per capita based on PPP for the ten ASEAN countries such that $y_t^* = \frac{\sum_{i=1}^{10} y_{it}}{10}$ (4.8)

The income gap will change for a period of time; in particular:

$$IG_{it+1} = \mu IG_{it} \quad (4.9)$$

The income gap between country i and the sample group will reduce if $\mu < 1$ and vice versa.

Trade openness, which is measured by total exports and import to GDP, can affect the trade balance which then affects the real exchange rate, inflation and real GDP which in turns affect the income gap. Therefore, we will employ data on trade openness for the conduct of a sensitivity analysis.

4.3.2. Exchange rate regime classification

The exchange rate regimes of the ASEAN countries, which are based on the *de facto* classification of the IMF, are summarised in Table C1 in Appendix C. The definition of these exchange rate regimes is presented in Table C2 in Appendix C. Following Ghosh (2014), this study accepts the three-way classifications of the exchange rate regime, including fixed, intermediate and floating exchange rate regimes. In particular, the fixed

[40] Most of the studies measure income as per capita GDP but is adjusted by PPP (Svedberg 2004).

exchange rate regime category includes - a country not having separate legal tender, operating a currency board and operating with a conventional fixed exchange rate regime. The intermediate exchange rate regime includes a peg with horizontal bands, crawling pegs, crawling band, stabilised arrangement and other managed arrangements. Finally, the floating exchange rate regime contains an independent float (or free floating) and managed floating with no predetermined band (or floating). Based on this three-way classification, the exchange rate regimes of ASEAN countries are grouped and documented in Table 4.1.

Table 4.1: ASEAN countries and their exchange rate regimes

Countries	Fixed years	Intermediate years	Floating years
Brunei	1999-2014		
Cambodia		2009-2012	1999-2008, 2013-2014
Indonesia		2010, 2012	1999-2009, 2011, 2013, 2014
Lao PRD		2008-2014	1999-2007
Malaysia	1999-2004		2005-2014
Myanmar	1999-2000	2008-2014	2001-2007
Philippines			1999-2014
Singapore		2009-2014	1999-2008
Thailand			1999-2014
Vietnam	2005-2007	1999-2000, 2008-2014	2001-2004

Source: Data from 1999-2014 is from AREAER and grouped following Ghosh (2014)

Dividing the exchange rate regimes of the ASEAN countries into fixed, intermediate and floating regimes results in a small data set for each exchange rate regime and this may affect the robustness of the empirical results derived. Hence, similar to Broda (2004) and for econometric purposes, the exchange rate regimes of the ASEAN countries are

condensed into two regimes, fixed and flexible exchange rate regimes, where the flexible exchange rate regime encompasses the intermediate and floating exchange rate regimes.

4.3.3. Descriptive statistics

To provide more insights into the data before conducting the empirical analysis in Chapter 5, this section presents descriptive statistics for the whole sample and two separate cases, namely the fixed and flexible exchange rate regimes in Table 4.2. It can be seen from the standard deviation in Table 4.2 that for the whole sample, in terms of external shocks, the world real oil price shock is subject to the most volatility, followed by a foreign real interest rate shock. Considering the fluctuation of domestic variables, real GDP is the most volatile, followed by the real exchange rate.

The whole data is spilt into fixed and flexible exchange rate regimes. Comparing the standard deviation of domestic variables between the fixed and flexible regime, it can be seen that most of the variables, except within-country income inequality are more volatile under a flexible rather than a fixed exchange rate regime. There is no difference in the variation of CPI between a fixed and a flexible exchange rate regime.

It can be seen from Table 4.2 that under a fixed exchange rate regime, all variables, except between-countries income gap, have right tails because they have positive skewness. Under a flexible exchange rate regime, foreign demand, world real oil price, CPI and within-country income gap are negatively skewed whereas other variables are positively skewed. The positive kurtosis value of variables in both exchange rate regimes shows that all variables have heavier tails and sharper peaks compared to the normal distribution. Meanwhile, probability shows that the null hypothesis of a normal distribution is rejected at the 1% significance level for all variables under both exchange rate regimes based on the Jarque-Bera test.

Table 4.2: Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Whole sample									
WO	0.04	0.04	0.06	-0.001	0.013	-1.25	5.46	97.28	0.0000
OIL	9.03	8.00	14.43	3.48	3.77	0.11	1.36	18.27	0.0000
IR	0.35	0.27	2.75	-1.92	1.43	0.14	1.86	9.25	0.0000
GDP	4.90	5.0	11.43	-1.77	3.72	0.04	2.37	3.11	0.2116
CPI	4.46	4.55	5.04	2.71	0.37	-1.92	8.66	369.59	0.0000
ER	5.02	3.82	10.15	0.17	3.72	0.08	1.34	21.94	0.0000
BI	-0.79	-1.14	1.58	-2.60	1.22	0.62	2.13	17.99	0.0001
WI	0.67	0.66	0.93	0.40	0.13	0.10	2.21	5.24	0.0729
Under a fixed exchange rate regime									
WO	0.01	0.00	0.056	-0.001	0.02	2.16	6.01	219.10	0.0000
OIL	0.89	0.00	14.31	0.00	2.37	3.46	17.36	2012.37	0.0000
IR	0.00	0.00	0.03	-0.02	0.01	2.27	10.59	521.90	0.0000
GDP	0.12	0.00	10.19	-1.77	1.59	4.73	29.22	6151.35	0.0000
CPI	0.69	0.00	4.63	0.00	1.65	1.92	4.73	140.23	0.0000
ER	0.27	0.00	10.07	0.00	1.31	6.71	49.21	18329.73	0.0000
BI	0.07	0.00	1.58	-2.56	0.57	-0.33	10.73	476.52	0.0000
WI	0.12	0.00	0.86	0	0.29	1.96	4.97	153.38	0.0000
Under a flexible exchange rate regime									
WO	0.03	0.04	0.06	-0.001	0.02	-0.79	2.45	22.20	0.0000
OIL	8.14	7.92	14.43	0.00	4.78	-0.38	1.91	13.78	0.0010
IR	0.00	0.00	0.03	-0.02	0.01	0.33	2.30	6.11	0.0472
GDP	4.77	4.42	11.43	0.00	3.52	0.35	2.22	8.69	0.0130
CPI	-0.69	0.00	0.00	-4.63	1.62	-1.92	4.73	140.23	0.0000
ER	4.75	3.78	10.15	0.00	3.84	0.10	1.36	21.68	0.0000
BI	-0.87	-1.08	1.26	-2.60	1.02	0.45	2.30	10.24	0.0006
WI	0.54	0.61	0.93	0.00	0.26	-1.11	3.30	39.69	0.0000

Note: WO: World output; OIL: World real oil price; IR: Foreign real interest rate; GDP: real GDP, ER: real exchange rate, CPI: Consumer price index, BI: Between-countries income gap, WI: Within-country income gap.

Source: Author

Table 4.2 highlights some differences in mean values between fixed and flexible exchange rate regimes. In particular, CPI increases under a fixed exchange rate regime but decreases under a flexible exchange rate regime. This shows there is inflation in a fixed exchange rate regime but deflation in a flexible exchange rate regime. In addition, real GDP is higher under a flexible exchange rate regime. Besides, the real exchange rate is higher under a flexible exchange rate regime. Furthermore, a country with a fixed exchange rate regime has greater income than the average income of the 10 ASEAN countries. However, the income of a country with a flexible exchange rate regime is lower than the average income of the group. Finally, the within-country income inequality is higher under a flexible exchange rate regime than under the fixed version.

4.3.4. Unit root test

4.3.4.1. Theoretical approach of the unit root test for panel data

Before conducting the statistical analysis all the variables are tested for a unit root. There is a plethora of tests for panel stationarity such as Levin-Lin-Chu (2002) (LLC), Harris–Tsavalis (1999) (HT), Breitung (2000), Im–Pesaran–Shin (2003) (IPS), Fisher-type (Choi 2001) and Hardi LM (2000).

Generally, the panel model for a unit root test is:

$$y_{it} = \rho_i y_{i,t-1} + z'_{it}\gamma_i + \varepsilon_{it} \qquad (4.10)$$

where y_{it} is the variable to be tested for the existence of a unit root; $i = 1, \dots, N$ are cross-section units, $t = 1, \dots, T$ is the time index; $z'_{it}\gamma_i$ is a panel fixed effect.

For most of the tests (LLC, HT, Breitung, IPS and Fisher-type), the null hypothesis for a panel unit root test is $H_0: p_i = 1$ (data have a unit root or are non-stationary) and the alternative hypothesis is $H_A: p_i < 1$ (data does not have a unit root and are stationary for one panel or some panels or all panels). However, in the Hardi LM test, the null hypothesis

is that all panels are stationary while the alternative hypothesis is that at least some panels are non-stationary. There are important differences between the types of tests. First, unbalanced data are permitted in the IPS, Hardi and Fisher-type tests while the remaining tests can only be applied to balanced datasets[41]. Second, some tests, such as the LLC, HT and Breitung tests assume that the autoregressive parameters (ρ) are common for all cross-sections while other tests have panel-specific (fixed effect) autoregressive parameters. Finally, the size of panels, N and time series T, is also different between the different types of tests. In particular, the LLC test is suitable for a moderate dataset with a smaller number of cross-sections relative to time periods. The HT test can be applied to the dataset with a large number of cross-sections. The Breitung, Fisher and Hardi tests are appropriate for a panel with a long time series. The IPS test can be applied for the case of any number of cross-sections and time periods.

The size of the sample always plays an important role in determining which test is suitable. It can be seen that the Breitung, Fisher, HT and Hardi tests are not appropriate for this study because both the number of cross-sections and time series are small. The data used in this study satisfy the sample size requirement of the LLC and IPS tests. However, the LLC test depends on restrictions on the common autoregressive parameters which is relaxed in the IPS test (Li & Liu 2005). This study includes data for ten ASEAN countries so the IPS test can deal better with the heterogeneity of the sample. Therefore, this study uses the IPS test to test for a unit root.

4.3.4.2. Results from the unit root tests

Variables tested for stationarity are all in logarithmic form, except for foreign demand, world real interest rate and between-countries income gap. Prior to conducting the unit root test, the series of these variables for each of the ten ASEAN countries are graphed

[41] A balanced dataset means that each cross-section has a similar number of observations.

to determine whether they have an intercept and/or a trend. The graphs indicate that all variables have intercepts but no trend[42]. However, the series will be tested for a unit root with an intercept.

The results from the unit root test are summarised in Table 4.3[43]. It can be seen from Table 4.3 that at the 5% level of significance, foreign demand and the world real oil price are stationary at a particular level while the foreign real interest rate, real GDP, real exchange rate, CPI, between-countries and within-country income gap are stationary in terms of first differences.

Table 4.3: Im-Pesaran-Shin (2003) unit root test results

Variables	Prob. at level	Prob. at first difference
Foreign demand	0.0000	
World real oil price	0.0488	
Foreign real interest rate	0.0991	0.0000
Real GDP	0.8701	0.0000
Real exchange rate	0.7611	0.0000
CPI	0.3049	0.0000
Between-countries income gap (BI)	1.0000	0.0000
Within-country income gap (WI)	0.0894	0.0000

Source: Author

4.3.5. Cointegration test

Engle and Granger (1987) showed that non-stationary variables may be linear stationary. This means that these variables are co-integrated and have a long-term relationship. This section will test for co-integration between the I(1) variables, namely

[42] See Figure C1in Appendix C.
[43] Detailed results of the unit root tests are shown in Table C4 in Appendix C.

foreign real interest rate, real GDP, real exchange rate, CPI, between-countries income gap and within-country income gap. There are three widely used methods to conduct a co-integration test for panel data, these being the Pedroni (1999, 2004), Kao (1999) and Fisher (1932) methods.

The Pedroni (1999, 2004) test allows for heterogeneous intercepts and trend coefficients across cross-sections. The regression function is as follows:

$$y_{it} = \alpha_i + \gamma_i t + \vartheta_{1i} x_{1i,t} + \vartheta_{2i} x_{2i,t} + \cdots + \vartheta_{Mi} x_{Mi,t} + e_{i,t} \quad (4.11)$$

where $\alpha_i$and γ_i are the intercept and trend coefficients; y, x are integrated of order one; t is the time period with t=1,…, T; i is cross-section with i=1,…,N; m=1, …, M; $e_{i,t}$ is a residual.

$$e_{it} = \varphi_i e_{it-1} + u_{it} \quad (4.12)$$

The null hypothesis of no co-integration requires $e_{i,t}$ to be integrated of order one I(1), meaning that φ_i=1. There are two alternative hypotheses, firstly, the homogenous alternative (φ_i<1) for every i and secondly, the heterogeneous alternative (φ_i<1)

Although the Kao (1999) test follows a similar approach to that of the Pedroni test, the intercept is heterogeneous for cross-sections and the parameters are homogenous across cross-sections.

$$y_{it} = \alpha_i + \vartheta x_{it} + e_{it} \quad (4.13)$$

$$y_{it} = y_{it-1} + \omega_{it} \quad (4.14)$$

$$x_{it} = x_{it-1} + \epsilon_{it} \quad (4.15)$$

where α_i is heterogeneous; ϑ is homogenous across cross- sections.

Using the Fisher (1932) method, the results for individual cross-section cointegration tests are combined to obtain the result for the full cross-sections.

This study is conducted for ten ASEAN countries which are heterogeneous in terms of their economic development. Hence, the Pedroni (1999, 2004) test is employed because it allows for heterogeneous intercepts and trend coefficients across the cross-sections. The co-integration test for the between-countries income gap model is conducted for the foreign real interest rate, real GDP, real exchange rate, CPI and between-countries income gap. In the model for within-country income gap, the foreign real interest rate, real GDP, real exchange rate, CPI and within-country income gap are used for the co-integration test.

The detailed results of the co-integration tests are shown in Table C5 and Table C6 in Appendix C. Results of the co-integration tests are summarised in Table 4.4 and Table 4.5.

Table 4.4: Panel cointegration test for the between-countries income gap model

Dependent variable	Panel rho-Statistic	Prob.
Foreign real interest rate	1.88	0.9700
Real GDP	2.04	0.9793
Real exchange rate	1.29	0.9020
CPI	1.35	0.9114
Between-countries income gap	1.84	0.9675

Table 4.5: Panel cointegration test for the within-country income gap model

Dependent variable	Panel rho-Statistic	Prob.
Foreign real interest rate	1.16	0.8763
Real GDP	1.46	0.9273
Real exchange rate	1.38	0.9172
CPI	0.89	0.8138
Within-country income gap	0.94	0.8253

It can be seen from Table 4.4 and Table 4.5 that all the outcomes are insignificant at

the 5% significance level. This means that the null hypothesis of no cointegration cannot be rejected. Consequently, there is no long-term relationship between the I(1) variables. Consequently, the VAR model will be estimated without imposing a cointegration relationship between the I(1) variables.

4.4. METHODOLOGY

4.4.1 Structural vector autoregressive model

This section describes the SVAR methodology which is widely employed by previous studies, for example Broda (2004), Zhang *et al.* (2014), Chia *et al.* (2012)[44]. The structural model has been expressed as a panel VAR in these studies. According to Canova and Ciccarelli (2013), the structure of panel VARs is the same as the VAR model in which all variables are assumed to be endogenous and interdependent[45]. However, a cross sectional dimension has been added and therefore the representation of panel VAR becomes:

$$Y_{it} = A_{0i}(t) + A_i(L)Y_{t-1} + u_{it}$$

where i=1,…, N (countries, sectors or markets); t=1,…, T (time).

The methodology SVAR is ideal for examining the effects and contribution of external shocks to macroeconomic variables. This methodology will be used to investigate the response of economic growth, inflation, real exchange rate and income gap to foreign demand shocks under fixed and flexible exchange rate regimes for ASEAN economies. The SVAR methodology is applied in this study because it can be used "to determine the dynamic responses of different economic variables to disturbances" (Bruneau & De Bandt 2003). Added to this, SVAR is employed because it is a useful tool that can investigate the model's dynamics when unexpected shocks occur (Gottschalk 2001). Furthermore,

[44] Pedroni (2013) has proposed a method investigating the decomposition and impulse responses into member-specific idiosyncratic and common structural shocks that drive the cross-sectional dependence among members. However, this method is outside the scope of my study. Hence, I follow Broda (2004), Chia et al. (2012), Zhang et al. (2014) which allow comparison of my results with past studies to be made.

45 The respresentation of VAR: Yt=A0t+ALYt-1+ut where A(L) is a polynomial in the lag operator (Canova & Ciccarelli 2013).

although the standard VAR model is a tool that examines the responses of endogenous variables to shocks, SVAR is better because, in the former model, endogenous variables are only explained by their lag values whereas the latter explains contemporaneous effects among endogenous variables (Pfaff 2008). Bruneau and De Bandt (2003) showed that these instantaneous effects are hidden in the correlation structure of the covariance matrix derived from the vector of innovation in the standard VAR model[46].

A SVAR model can be expressed in the following way as illustrated below:

$$\begin{vmatrix} 1 & a_{12} & \dots & \dots & a_{1n} \\ a_{21} & 1 & \dots & \dots & a_{2n} \\ \cdot & \cdot & \cdot & \dots & \cdot \\ a_{n1} & a_{n2} & \dots & \dots & 1 \end{vmatrix} \begin{pmatrix} y_{1t} \\ y_{2t} \\ \dots \\ y_{nt} \end{pmatrix} = \begin{vmatrix} a(L)_{11} & a(L)_{12} & \dots & \dots & a(L)_{1n} \\ a(L)_{21} & a(L)_{22} & \dots & \dots & a(L)_{2n} \\ \cdot & \cdot & \cdot & \dots & \cdot \\ a(L)_{n1} & a(L)_{n2} & \dots & \dots & a(L)_{nn} \end{vmatrix} \begin{pmatrix} y_{1t} \\ y_{2t} \\ \dots \\ y_{nt} \end{pmatrix} +$$

$$\begin{vmatrix} b_{12} & 0 & \dots & \dots & 0 \\ 0 & b_{22} & \dots & \dots & 0 \\ \cdot & \cdot & \cdot & \dots & \cdot \\ 0 & 0 & \dots & \dots & b_{nn} \end{vmatrix} \begin{pmatrix} u_{1t} \\ u_{2t} \\ \cdot \\ u_{nt} \end{pmatrix} \qquad (4.16)$$

Or in the form:

$$AY_{it} = A(L)Y_{it} + Bu_{it} \qquad (4.17)$$

where: Y_{it}: (nx1) vector of stationary endogenous variables

A: (nxn) matrix of structural parameters for the contemporaneous link between variables.

B: a diagonal matrix that describes the contemporaneous responses of endogenous variables to shocks.

A(L): (nxn) matrix of polynomial lag operators of order k.

u_{it}: (nx1) vector of structural innovation or structure errors with var(u_{it})=Ω.

[46] The standard form or reduced form of the VAR model is $Y_t = \sum_{p=1}^{t} A_p Y_{t-p} + Bx_t + u_t$ where $y_t$are endogenous variables; x_t: exogenous variables; y_{t-p}: lagged endogenous variables; u_t: vector of innovations; A_p and B are matrices of coefficients.

The SVAR model (4.17) can be estimated by transforming it into a reduced form or standard VAR. Pre-multiplying SVAR by A^{-1}, we get:

$$Y_{it} = A^{-1}A(L)Y_{it} + A^{-1}Bu_{it} \quad (4.18)$$

Set $D(L) = A^{-1}A(L)$; $e_{it} = A^{-1}Bu_{it}$, yields the reduced form as follows

$$Y_{it} = D(L)Y_{it} + e_{it} \quad (4.19)$$

To construct the matrix A it is necessary to impose an identification restriction. There are two issues when imposing identification restrictions. First, does the model have a recursive or non-recursive structure? Second, does the model require short-run or long-run restrictions to be imposed?

For the first issue, the recursive model is known as Choleski decomposition, in which the restriction is imposed so that the value of the latter variable does not have a contemporaneous effect on the previous variable. Stock and Watson (2001) assert that in recursive VAR, the error term of the subsequent equation is not correlated to the error term of the previous equation. Hence, the dependent variable of the first equation is a function of lagged values of all variables. The dependent variable of the second equation is a function of lagged values of all variables plus the current value of the dependent variable in the first equation. Similarly, the dependent variable of the third equation is a function of lagged variables of all variables plus the current value of dependent variables of the first and second equations. In the non-recursive VAR, contemporaneous relationships between variables (or restrictions) are based on economic theory.

With regard to the second issue, an identification strategy can be implemented by imposing short-run and/or long-run restrictions. Schwert (2009) showed that the identification restriction in the short-run commonly has the form Ae=Bu. Long-run

restrictions are proposed by Blanchard and Quah (1988). Schwert (2009) indicates that the long-run response to structural innovation has the following form:

$$C=\widehat{\Psi}_{\infty}A^{-1}B \tag{4.20}$$

where $\widehat{\Psi}_{\infty}=(I-\widehat{A}_1-\cdots-\widehat{A}_p)^{-1}$ is the forecast accumulated responses to the reduced form shocks. The author shows that long-run restrictions are imposed in the form of zero restrictions in elements of matrix C. The restriction $C_{ij}=0$ shows that the j-th structural shock has no long-run accumulated impact on the response of the i-th variable (Schwert 2009).

This study will apply the non-recursive VAR model because the contemporaneous relationship of variables is based on economic theory. This study considered the short-run restriction because output is not affected by demand shocks in the long-run (Bayoumi & Eichengreen 1992).

4.4.2. Contemporaneous restrictions

We estimate the panel SVAR model for between-countries income gap as follows

$$AY_{it}=c_{it}+A(L)Y_{it}+u_{it} \tag{4.21}$$

where $Y_{it}=\begin{pmatrix} EX_{it} \\ \Delta LGDP_{it} \\ \Delta LCPI_{it} \\ \Delta LER_{it} \\ \Delta BI_{it} \end{pmatrix}$ is a column vector of stationary endogenous variables, including external variables (foreign demand, the logarithm of the world oil price and first difference of the foreign real interest rate), first differences of the logarithm of output, logarithm of the price level, logarithm of the real exchange rate and the first difference of the between-countries income gap. In terms of external shocks, a foreign demand and world real oil price will be estimated at level whereas foreign real interest rate is estimated

at first difference. Importantly, we aim to separately investigate the effects of different types of external shocks to avoid the interaction between external shocks.

Here, A is a contemporaneous matrix, A(L) are 5x5 matrices of polynomials in the lag operator of order k and $u_{it} = (u_{it}^{EX}, u_{it}^{RGDP}, u_{it}^{CPI}, u_{it}^{RER}, u_{it}^{BI})$ is a vector of structural errors; c_{it}: country specific effect.

Similarly, the panel SVAR model for within-country income gap as follows:

$$AY_{it} = \mathrm{c_{it}} + A(L)Y_{it} + u_{it} \qquad (4.22)$$

where $Y_{it} = \begin{pmatrix} EX_{it} \\ \Delta LGDP_{it} \\ \Delta LCPI_{it} \\ \Delta LER_{it} \\ \Delta WI_{it} \end{pmatrix}$ is a column vector of stationary endogenous variables, including external variables (foreign demand, the logarithm of the world oil price and first difference of the foreign real interest rate), first differences of the logarithm of output, logarithm of the price level, logarithm of the real exchange rate and the first difference of the logarithm of within-country income gap. $u_{it} = (u_{it}^{EX}, u_{it}^{RGDP}, u_{it}^{CPI}, u_{it}^{RER}, u_{it}^{WI})$ is a vector of structural errors; c_{it}: country specific effect.

The SVAR model for ASEAN countries with short-run restrictions is based on $\mathrm{Ae_{it}} = \mathrm{Bu_{it}}$. The links between innovations $\mathrm{u_{it}}$ and structural shocks $\mathrm{e_{it}}$ are symbolised as follows. The matrices that are presented in the following studies include three values. First, a zero value indicates no relationship exists between variables. Second, a unity value shows the contemporaneous relationship of the variables themselves. Finally, the remaining variables indicate a contemporaneous relationship between variables. A good example is that $\mathrm{a_{ij}}$ indicates that variable j wields a contemporaneous impact on variable i.

The SVAR model for between-countries income gap for ASEAN countries with short-run restrictions is based on $\mathrm{Ae_{it}} = \mathrm{Bu_{it}}$ or

$$\begin{vmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{vmatrix} \begin{pmatrix} e_{it}^{EX} \\ e_{it}^{GDP} \\ e_{it}^{CPI} \\ e_{it}^{ER} \\ e_{it}^{BI} \end{pmatrix} = \begin{vmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{vmatrix} \begin{pmatrix} u_{it}^{EX} \\ u_{it}^{GDP} \\ u_{it}^{CPI} \\ u_{it}^{ER} \\ u_{it}^{BI} \end{pmatrix} \quad (4.23)$$

Similarly, the SVAR model for within-country income gap for ASEAN countries with short-run restrictions is based on $Ae_{it} = Bu_{it}$ or

$$\begin{vmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{vmatrix} \begin{pmatrix} e_{it}^{EX} \\ e_{it}^{GDP} \\ e_{it}^{CPI} \\ e_{it}^{ER} \\ e_{it}^{WI} \end{pmatrix} = \begin{vmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{vmatrix} \begin{pmatrix} u_{it}^{EX} \\ u_{it}^{GDP} \\ u_{it}^{CPI} \\ u_{it}^{ER} \\ u_{it}^{WI} \end{pmatrix} \quad (4.24)$$

As indicated by Basnet and Upadhyaya (2015), most of the ASEAN countries are small economies and, hence, foreign variables are not affected instantaneously by changes in domestic variables. Therefore, external shocks are assumed to have a contemporaneous impact on domestic variables whereas domestic variables have no effects on external shocks. Hence, we assume that in both models a_{12}=a_{13} = a_{14}=0.

The real exchange rate responds rapidly to related economic changes and, hence, it is affected contemporaneously by other variables in the economic system. In addition, the movement of the real exchange rate is influenced by changes in the nominal exchange rate and/or price. Therefore, this study assumes that the real exchange rate is affected instantaneously by foreign demand, economic growth and inflation. However, the real exchange rate has no contemporaneous effect on economic growth and inflation. Manalo *et al.* (2015) explained that this is because firms need time to adjust prices and make production decisions in response to changes in the exchange rate. Hence, regarding the between- countries income gap and within-country income gap models, this amounts to imposing the restrictions that a_{24}=a_{34}=0.

Similar to Gumata and Ndou (2017), this study assumes that growth responds slowly to inflation whereas inflation is affected instantaneously by economic growth. Hence, for both models we assume a_{23}=0. Following Lim and McAleer (2004), the between-countries income gap in this study is calculated based on GDP per capita and subsequently this study assumes that changes in output, which affects GDP per capita immediately affect the between-countries income gap. Following Partridge (2005), this study assumes that the level of economic development has contemporaneous impacts on within-country income gap.

In addition, due to the assumption of contemporaneous effects of external shocks on output which then exerts contemporaneous impacts on the between-countries and within-country income gap, a foreign demand shock is assumed to have an instantaneous impact on the income gap. Based on the immediate effect of the real exchange rate on domestic and foreign income, as shown in Section 2.2.4, this study assumes that the real exchange rate has a contemporaneous impact on the income gap. Moreover, as a consequence of the immediate impact of the price level on the real exchange rate, this study assumes that the price level has a contemporaneous effect on the income gap.

However, it is assumed that the between-countries and within-country income gaps have no contemporaneous effect on external shocks, output, price level and real exchange rate because in reality the fluctuations of four of these variables are not directly affected by the between-countries and within-country income gap[47]. Hence, in both models we have made the assumption a_{15}=a_{25}=a_{35} = a_{45}=0.

Based upon the above assumptions, the SVAR model for between-countries gap model will become:

[47] It is stated by Alesina and Perotti (1996) and Ramos and Roca - Sagales (2008) that economic growth seems to only respond to fluctuations of inequality in the long-run. This is because within-country income inequality needs time to make an impact on economic growth via human capital accumulation.

$$EX_{it}=c_{it}^{EX}+\sum_{j=1}^{k}a_{11}^{j}\,EX_{it-j}+e_{it}^{EX} \quad (4.25)$$

$$GDP_{it}=c_{it}^{GDP}-a_{21}^{0}EX_{it}+A_2(L)Y_{it}+e_{it}^{GDP} \quad (4.26)$$

$$CPI_{it}=c_{it}^{CPI}-a_{31}^{0}EX_{it}-a_{32}^{0}GDP_{it}+A_3(L)\mathrm{Y}_{it}+e_{it}^{CPI} \quad (4.27)$$

$$ER_{it}=c_{it}^{ER}-a_{41}^{0}EX_{it}-a_{42}^{0}GDP_{it}-a_{43}^{0}CPI_{it}+A_4(L)Y_{it}+e_{it}^{ER} \quad (4.28)$$

$$BI_{it}=c_{it}^{BI}-a_{51}^{0}EX_{it}-a_{52}^{0}GDP_{it}-a_{53}^{0}CPI_{it}-a_{54}^{0}ER_{it}+A_5(L)Y_{it}+e_{it}^{ER} \quad (4.29)$$

Similarly, the SVAR model concerning the within-countries income gap will become:

$$EX_{it}=c_{it}^{EX}+\sum_{j=1}^{k}a_{11}^{j}\,EX_{it-j}+e_{it}^{EX} \quad (4.30)$$

$$GDP_{it}=c_{it}^{GDP}-a_{21}^{0}EX_{it}+A_2(L)Y_{it}+e_{it}^{GDP} \quad (4.31)$$

$$CPI_{it}=c_{it}^{CPI}-a_{31}^{0}EX_{it}-a_{32}^{0}GDP_{it}+A_3(L)\mathrm{Y}_{it}+e_{it}^{CPI} \quad (4.32)$$

$$ER_{it}=c_{it}^{ER}-a_{41}^{0}EX_{it}-a_{42}^{0}GDP_{it}-a_{43}^{0}CPI_{it}+A_4(L)Y_{it}+e_{it}^{ER} \quad (4.33)$$

$$WI_{it}=c_{it}^{WI}-a_{51}^{0}EX_{it}-a_{52}^{0}GDP_{it}-a_{53}^{0}CPI_{it}-a_{54}^{0}ER_{it}+A_5(L)Y_{it}+e_{it}^{WI} \quad (4.34)$$

Following Broda (2004), the exchange rate regime is grouped into two groups, specifically fixed and flexible exchange rate regimes, as mentioned previously. The flexible exchange rate regime encompasses the intermediate and floating exchange rate regimes. To distinguish the fluctuation of variables between different exchange rate regimes, $\mathrm{Y_{it}}$ will be interacted with dummy variables for different exchange rate regimes ($\mathrm{D_{peg}}$=0 if fixed and $\mathrm{D_{flex}}$=1 if a flexible exchange rate regime).

Hence, the SVAR model is as follows:

$$\mathrm{Y_{it}}=\mathrm{C_{it}}+A_{\mathrm{peg}}(\mathrm{L})\mathrm{Y_{it}}*\mathrm{D_{peg}}+A_{\mathrm{flex}}(\mathrm{L})\mathrm{Y_{it}}*\mathrm{D_{flex}}+e_{\mathrm{it}} \quad (4.35)$$

4.5. CONCLUDING REMARKS

This chapter has presented a theoretical framework and a structural VAR model. To contribute to the existing literature and extend it, this chapter has devised two empirical models that are applicable to ASEAN countries. The first model - model for the between-countries income gap - highlights the relationship between variables, namely external shocks, output, real exchange rate, price level and between-countries income gap. The relationship between external shocks, output, real exchange rate, price level and within-country income gap has also been illustrated for the within-country income gap model. This study has also examined issues concerning the SVAR model's contemporaneous short-run and long-run restrictions and two types of SVAR forms, recursive and non-recursive. The SVAR model for ASEAN countries takes a non-recursive form because it can overcome the limitations of the recursive form in which the contemporaneous relationships between variables are permitted based on economic theory.

To estimate the empirical model, 160 annual observations have been collected for the 10 ASEAN countries covering the period from 1999 to 2014. Data are collected from accurate and reliable sources, these being the IMF, World Bank, UNCTAD and UNDP. Based on the *de facto* exchange rate regime of the IMF, the exchange rate regimes of the ASEAN countries are divided into fixed, intermediate and floating regimes. However, due to the small sample size for each of these three exchange rate regimes (fixed, intermediate and floating), they are, instead, grouped into two exchange rate regimes, namely a fixed and flexible exchange rate regime (which includes intermediate and floating exchange rate regimes).

From an empirical perspective, it emerged that all variables are not normally distributed. Moreover, the world oil price has experienced the most fluctuations compared to other external shocks. In terms of domestic variables, real GDP exhibits the most

volatility. Most of the variables fluctuate by more under a flexible rather than under a fixed exchange rate regime. Before conducting the empirical analysis, the stationarity of endogenous variables was tested using the Im-Pesaran-Shin (2003) test. The results indicate that the foreign real interest rate, real GDP, real exchange rate, CPI, between-countries and within-country income gaps are stationary at first difference while foreign demand and world real oil price are stationary in the level.

Engle and Granger (1987) in their study contended that non-stationary variables may be linear stationary. Hence, the Pedroni (1999, 2004) co-integration test was applied to the two models to examine whether there is a long-run relationship between the non-stationary variables. Results from the co-integration tests show there is no co-integration among the foreign real interest rate, real GDP, real exchange rate, CPI, between-countries and within-country income gap. Finally, based on the outcomes of unit root and co-integration tests, the SVAR model is estimated at the level for foreign demand and world real oil price. In addition, the model will be estimated with the first difference of the foreign real interest rate, real GDP, real exchange rate, inflation, between-countries and within-country income gap. The results from this estimation are presented in the following chapter.

CHAPTER 5: EMPIRICAL RESULTS FOR THE BETWEEN-COUNTRIES INCOME GAP MODEL

5.1. INTRODUCTION

This chapter presents the empirical results of the SVAR model for ASEAN countries constructed in Chapter 4. This chapter aims to investigate and compare the impacts of a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock on real GDP, the price level, real exchange rate and between-countries income gap between a fixed and a flexible exchange rate regime for all 10 ASEAN countries. In this study, a negative foreign demand shock is proxied by a one standard deviation fall in world real output. A positive world real oil price shock is proxied by a one standard deviation increase in the world real oil price. A positive foreign real interest rate shock is proxied by a one standard deviation increase in the foreign real interest rate.

In doing so, we use the impulse response function to capture the dynamic response of each variable under a fixed and a flexible exchange rate regime to each type of shock. Another objective of this chapter is to investigate and compare the degree to which each type of shock influences the fluctuation of each variable under a fixed and a flexible exchange rate regime. To obtain the desired results, the variance decomposition will be used for each variable under a fixed and a flexible exchange rate regime.

Notably, in this study, real GDP and CPI are estimated in the first difference of logarithm form, which turns out to be economic growth and inflation. The rise/fall in economic growth means there is an increase/decrease in real output. As well, the increase/decrease in inflation means an increase/decrease in the price level. Hence, we use interchangeably the terms increase/decrease in real GDP and increase/decrease in economic growth. The interchangeability is also applied to the scenario of an

increase/decrease in price level and increase/decrease in inflation. It is worth noting that this interchangeability was applied in other studies and in particular the first difference of logarithm of these variables. For example, see Broda (2004), Zhang *et al.* (2014), Basnet and Upadhyaya (2015), Zaidi *et al.* (2013), Al-Abri (2013), Hoffmann (2007) and Chia *et al.* (2012).

To obtain the desired empirical results, EVIEWS-8 software will be used to estimate the Structural VAR model. The research methodology involves the following steps:

(1) Conducting lag length selection and stability. There are some criteria for choosing the optimal lag length[48]. Due to the limited data observations, however, this study does not consider higher order lags. The optimal lag length also needs to satisfy stability. Therefore, the AR Characteristic Polynomial test will be applied to check the stability of the SVAR model. If the eigenvalues lie inside the unit circle then the model satisfies the stability requirement.

(2) Testing the exogeneity of external shocks by using the Granger causality test. In Chapter 4, it was assumed that external shocks are exogenous because ASEAN countries are price takers and, therefore, their domestic macroeconomic variables have no effect on foreign demand. To identify this assumption, a Granger causality test is applied to determine whether there is a causal relationship between domestic variables and external shocks.

(3) Reporting the results of impulse response to compare the responses of variables to each type of external shock between a fixed and a flexible exchange rate regime.

[48] namely LR: sequential modified LR test statistic, FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

(4) Reporting the results of variance decomposition so that the contribution of each type of shock on the fluctuation of variables under a fixed and a flexible regime can be evaluated.

(5) Conducting robustness tests by changing the order of the price level and the real exchange rate in the contemporaneous matrix.

This chapter is organised as follows. Section 5.2 presents the lag length selection and stability check. The investigation of exogeneity is described in Section 5.3. Section 5.4 discusses the empirical results. Section 5.5 concludes the discussion of this chapter.

5.2. LAG LENGTH SELECTION AND STABILITY CHECK

Due to limited data observations, this study does not consider higher order maximum lags. This study considers 7 lags as maximum lags. Table 5.1 summarises the results for the optimal lag length which are chosen using some specific criteria[49].

Table 5.1: Results for optimal lag length

	LR	FPE	AIC	SC	HQ
Foreign demand shock					
1 lag		x		x	x
7 lags	x		x		
World real oil price shock					
1 lags				x	x
7 lags	x	x	x		
Foreign real interest rate shock					
1 lag				x	
4 lags					x
5 lags	x	x	x		
6 lags	x	x	x		x
7 lags	x	x	x	x	x

Source: Author

[49] namely LR, FPE, AIC, SC and HQ

Considering the foreign demand shock, it can be seen from Table 5.1 that HQ, SC and FPE suggests a lag length of 1 while 7 lags are chosen by LR and AIC. We choose 1 lag for estimating SVAR because it is chosen by more criteria. This lag length also satisfies the stability requirement[50].

In terms of an oil price shock, 1 lag and 7 lags are selected. 1 lag is selected by the SC and HQ criteria. This lag length satisfies the requirement for stability. Although 7 lags are selected by more criteria (namely LR, FPE and AIC) than the 1 lag length, it does not satisfy the requirement of stability because some roots lie outside the unit circle[51]. Hence, 1 lag is chosen for the oil price shock model.

Referring to the foreign real interest rate shock, at first we conduct a lag selection with a maximum of 7 lags. It emerges that all criteria select 7 lags as the optimal lag length. However, model with 7 lags does not satisfy the stability requirement because some roots lie outside the unit circle. Hence, we implement another lag selection with a maximum of 6 lags. This lag length also does not satisfy the requirement of stability. Therefore, maximum of 5 lags is chosen for conducting the lag selection. The result indicates that the optimal lag length can be 1 lag, 4 lags and 5 lags. However, the stability condition does not satisfy with 5 lags. Hence, we conduct a likelihood ratio (LR) test to decide whether the optimal lag is 1or 4[52]. The findings indicate that the model with 1 lag is the best. Therefore, we choose 1 lag for estimating SVAR. This lag length also satisfies the

[50] See Figure D1 in Appendix D.
[51] See Table D2 and Figure D2 in Appendix D.
[52] The likelihood ratio test statistic is $LR^{*}=2*\{lr(m2)-lr(m1)\}$, where lr(m1): likelihood of restricted model (1 lag); lr(m2): likelihood of unrestricted model (4lags). From the VAR estimation, we have lr(m2)=1146.52 and lr(m1)=1330.6. We then compare LR^{*} and the critical value with the Chi distribution, 75 degrees of freedom at α=5% (104.88). If $LR^{*}>$ critical value then we reject the null hypothesis that the restricted model is better than the unrestricted model. Hence, we do not reject the null hypothesis and conclude that the model with 1 lag is better than the model with 4 lags.

stability requirement[53]. To conclude, 1 lag is chosen for the model dealing with the foreign demand, world real oil price and foreign real interest rate shocks.

5.3. EXOGENEITY OF EXTERNAL SHOCKS

Table 5.2: Granger causality test for the between-countries income gap model

	Chi-sq	**Prob.**
1. Foreign demand with 1lags		
Real GDP does not Granger-cause foreign demand	8.67E-07	0.9993
CPI does not Granger-cause foreign demand	2.506	0.1132
Real exchange rate does not Granger-cause foreign demand	0.3531	0.5523
Between-countries income gap does not Granger-cause foreign demand	0.5497	0.4584
2. Oil price with 1 lags		
Real GDP does not Granger-cause world real oil price	0.1084	0.7420
CPI does not Granger-cause world real oil price	0.2705	0.6030
Real exchange rate does not Granger-cause world real oil price	0.1679	0.6820
Between-countries income gap does not Granger-cause world real oil price	0.3014	0.5830
3. Foreign real interest rate shock with 1 lag		
Real GDP does not Granger–cause foreign real interest rate	0.0248	0.8749
CPI does not Granger-cause foreign real interest rate	0.7982	0.3716
Real exchange rate does not Granger-cause foreign real interest rate	0.5848	0.4444
Between-countries income gap does not Granger-cause foreign real interest rate	0.0013	0.9713

Source: Author

As discussed in Section 4.3.3, most of the ASEAN countries are small economies and, hence, it is assumed that domestic variables have no effect on external shocks. Like previous studies such as those by Hoffmann (2007), Chia *et al.* (2012), Al-Abri (2013), Zhang *et al.* (2014) and Basnet and Upadhyaya (2015), we have tested the exogeneity of

[53] See Figure D1 in Appendix D.

external shocks by using a causality test. This study applies the Granger causality test. The results are summarised in Table 5.2. At the 5% significance level, we do not reject the null hypothesis that each variable (namely real GDP, CPI, real exchange rate and between-countries income gap) does not Granger-cause external shocks. Thus, the results suggest that none of the variables, namely real GDP, CPI, real exchange rate and between-countries income gap, Granger-cause external shocks. This outcome confirms the assumption that the domestic variables of the 10 ASEAN countries have no effect on external shocks.

5.4. EMPIRICAL RESULTS

5.4.1. Impulse response function

According to Zhang *et al*. (2014), impulse response function describes the behaviour of one variable to one shock of another variable in the system, while assuming other types of shocks equal zero. Figure 5.1 below shows the impulse responses and accumulated impulse responses of real GDP, CPI, real exchange rate and between-countries income gap to a negative one standard deviation foreign demand shock under a fixed (left-hand panel) and flexible exchange rate regime (right-hand panel).

The solid line indicates the impulse response function while the dashed lines depict the 90% confidence intervals (with 5th and 95th percentiles). An analytic (asymptotic) response standard error is applied to generate the impulse response of variables to foreign demand shocks over 20 periods.

i. Foreign demand shock

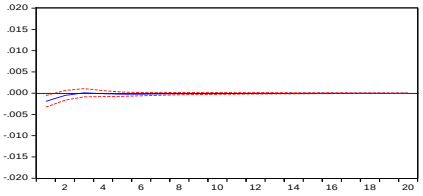
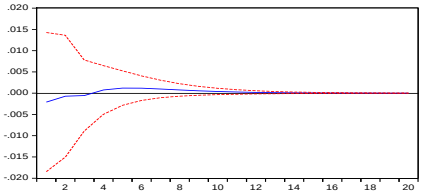
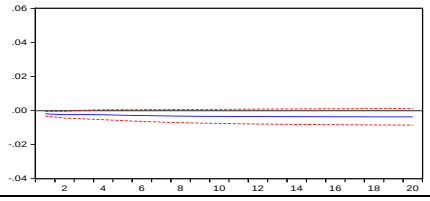
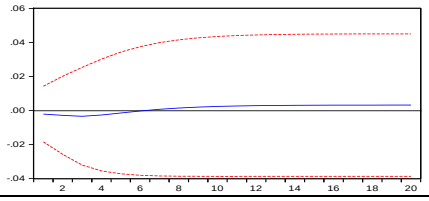
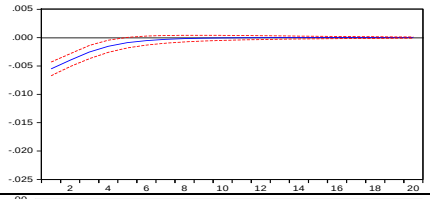
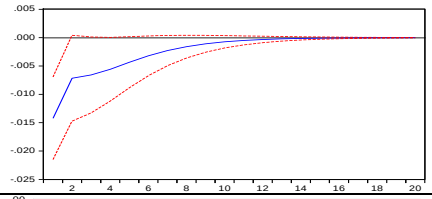
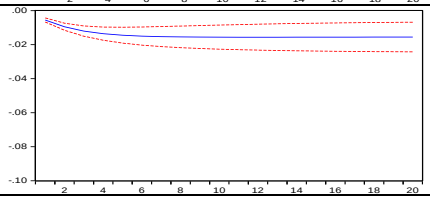
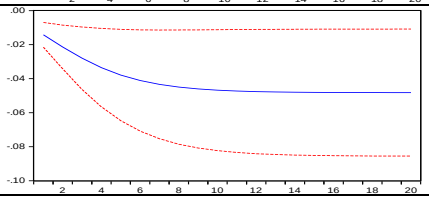
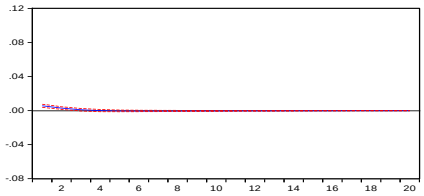
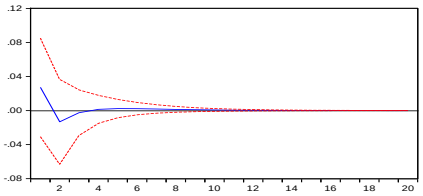
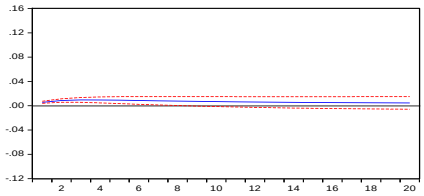
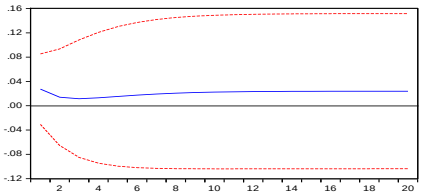
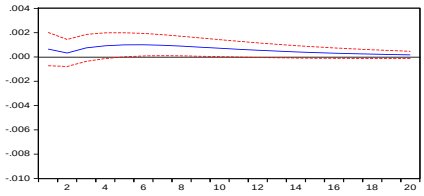
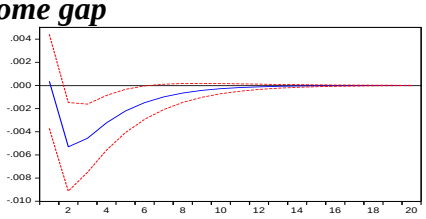
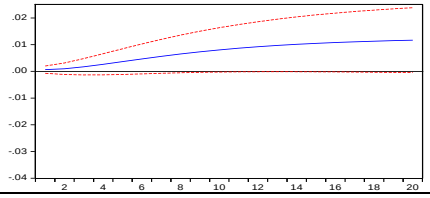
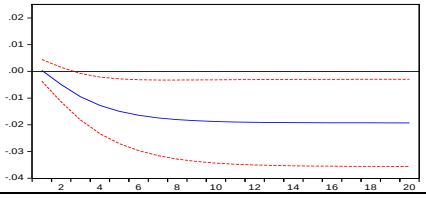
	Fixed ERR	Flexible ERR
a. Real GDP		
Impulse response		
Accumulated impulse response		
b. Price level		
Impulse response		
Accumulated impulse response		
c. Real exchange rate		
Impulse response		
Accumulated impulse response		
d. Between-countries income gap		
Impulse response		
Accumulated impulse response		

Figure 5.1: Impulse response of a negative foreign demand shock

Figure 5.1a compares the impulse response and accumulated impulse response of real GDP to a positive foreign demand shock under fixed and flexible exchange rate regimes. It can be seen that a negative unanticipated foreign demand shock leads to a contemporaneous real output decline under both exchange rate regimes. This is consistent with the literature which agrees that negative foreign demand shocks decrease exports and output. As well, the economic policies of the ASEAN countries are generally export-driven and hence the decrease in foreign demand leads to an output contraction through export channels. The shock has a more prolonged effect on real output when a flexible exchange rate regime is operating. In particular, the shock lasts for 9 periods under a flexible exchange rate regime, but just 3 periods under a fixed exchange rate regime. In addition, the response is observed to be more volatile under a flexible regime than under a fixed regime. This is confirmed by the fact that under the fixed exchange rate regime real GDP declines contemporaneously by 0.19%, but decreases by 0.21% under the flexible regime[54].

The finding that real output experiences a larger fluctuation more so under a fixed regime rather than a flexible exchange rate regime is consistent with the findings of Shi *et al.* (2015). They show that two important trade characteristics of some ASEAN countries that affect the superiority of a flexible exchange rate regime in buffering the foreign demand shock in terms of real output are "weak input substitution between local labour and import intermediated inputs in traded goods production" and "extensive use of foreign currency in export pricing". These characteristics restrain the adjustment role of the exchange rate, which makes the flexible exchange rate regime become inferior compared to a fixed exchange rate regime. To explain this, in the short-run, the prices of exported goods are fixed in terms of foreign currency and hence, the devaluation as a result of a negative foreign demand shock cannot improve export competitiveness. Furthermore,

[54] See Table D6 and Table D7 in Appendix D for the results.

aggregate output in the trade sector is fully affected by foreign demand shocks when export prices are fixed. On the production side, low substitutability between imported inputs and domestic inputs weakens the expenditure-switching effect in input substitution. This means cost of imported inputs is mostly affected by the devaluation. A benefit of the flexible exchange rate regime in buffering the effect of the shock on real output vanishes. Meanwhile, cost of imported inputs is not affected by changes of exchange rate under a fixed exchange rate regime. It means that a negative foreign demand shock reduces output contemporaneously more under a flexible rather than under a fixed exchange rate regime.

In terms of accumulated responses, the shock leads to lower economic growth under a fixed exchange rate regime. Economic growth also decreases under a flexible exchange rate regime but just in the short-run. Over the longer term horizon, the shock generates higher economic growth under a flexible exchange rate regime.

The greater output fluctuation under a flexible exchange rate regime in this study differs from those documented in previous studies, such as Lindert and Pugel (1996), Broda (2004), Chia and Alba (2006), Hoffmann (2007), Chia *et al.* (2012) and Zhang *et al.* (2014), who find that the instantaneous output contraction is greater under a fixed exchange rate regime. A good example of this is the work by Lindert and Pugel (1996), which shows that a negative foreign demand shock results in domestic currency depreciation and, hence, under a fixed exchange rate regime the central bank will intervene by selling foreign exchange reserves and buying the domestic currency. They indicate that if this intervention is not supported by sterilisation then the money supply will decline and real national product will further decline. Nonetheless, the non-intervention of a government under a floating exchange rate regime will improve domestic competitiveness, which leads to rising exports and falling imports. As a result, real domestic output will improve.

The high degree of economic openness of ASEAN countries may be a factor eroding the superiority of their flexible exchange rate regime in terms of output stability. As is shown by Watson (2016), high economic openness leads to greater firm competitiveness which reduces price stickiness. Under a flexible exchange rate regime, the depreciation of the real exchange rate is affected not only by the flexible movement of the nominal exchange rate but also by the less rigid movement of the price level. This limits the movement of the real exchange rate. As a result, the flexible exchange rate regime is not the best tool in buffering the effect of a negative foreign demand shock on the short-run real GDP of ASEAN countries.

Following Cook (2004) and Towbin and Weber (2013), the greater contraction of output under a flexible exchange rate regime in this study can be explained as follows. The nominal depreciation originating from the foreign demand shock leads to the dominated foreign currency debts of ASEAN countries becoming more expensive in terms of domestic currency and hedging[55]. This increases the borrowing cost and limits investment. Consequently, the decline in investment results in more contraction in domestic demand and real output under a flexible exchange rate regime compared to under a fixed one.

In terms of responses of the price level, it can be seen from Figure 5.1b that the contemporaneous impact of a foreign demand shock on the price level depicts a decline under both exchange rate regimes. In particular, the foreign demand shock reduces the price level contemporaneously to 0.055% and 1.42%, respectively, under the fixed and flexible exchange rate regimes. The effect of the shock is greater and more long-lasting under a flexible exchange rate regime. The greater volatility of the price level under a fixed exchange rate regime can be explained in that the immediate response of nominal exchange rate under a flexible exchange rate regime leads to faster changes in the imported

[55] Sangaré (2016) shows that the debt of ASEAN countries is dominated mainly by foreign currency

price and then the price level. However, under a fixed exchange rate regime the intervention of a government to maintain a fixed rate which changes money supply and then the price level, is passive and time-lagged (Terra 2015).

The contemporaneous decrease in the price level to a foreign demand shock for ASEAN countries with a fixed exchange rate regime is consistent with theory. In particular, Lindert and Pugel (1996) argue that under a fixed exchange rate regime, a central bank has to buy domestic currency to prevent nominal depreciation which is a consequence of a negative foreign demand shock. They show that this intervention results in a decline in domestic money supply which in turn lowers the price level.

Figure 5.1c depicts the movement of the real exchange rate to a negative foreign demand shock under both fixed and flexible exchange rate regimes. If the solid line is above the time horizon then the domestic currency is real depreciated. However, a domestic currency appreciation occurs when the solid line is under the horizontal line. The real exchange rate is weakly affected by external shocks under a fixed exchange rate regime, while it fluctuates more under a flexible exchange rate regime. For example, one negative standard deviation of a foreign demand shock contemporaneously leads to a 0.056% real appreciation under the fixed regime but a 2.73% real depreciation under the flexible regime[56].

In the short-run, price is sticky and hence, the muted effect of shocks on the real exchange rate under a fixed exchange rate regime is due to the intervention of monetary authorities attempting to fix the nominal exchange rate. However, the instantaneous real depreciation under a flexible exchange rate regime is largely driven by the changes of the nominal exchange rate to shocks where prices and wages are sticky in the short-run. Therefore, the real exchange rate is more volatile to the shock under a flexible exchange rate regime than under a fixed exchange rate regime, and this can be explained by the price

[56] See Table D6 and Table D7 in Appendix D for the results.

adjusting slowly because of its stickiness in the short-run while nominal exchange rate responds more rapidly. Consequently, the real exchange rate responds faster to the shock under a flexible than under a fixed exchange rate regime.

Figure 5.1d illustrates the responses and accumulated responses of between-countries income gap to a negative foreign demand shock under fixed and flexible exchange rate regimes. If the solid line is above the horizontal line then the between-countries income gap increases and vice versa. For both exchange rate regimes, a negative foreign demand uncertainty causes an instantaneous decline in between-countries income gap. Under the fixed exchange rate regime, the between-countries income gap increases in the third year until the shock is less influential as time passes. Under a flexible exchange rate regime, the between-countries income gap is reduced during 9 periods after the foreign demand shock. After that, it returns to the steady state value. In terms of the accumulated impulse response, it can be seen that under a flexible exchange rate regime, a negative foreign demand shock leads to accumulated declines in the between-countries income gap. However, the accumulated response of the income gap indicates that it is insignificant affected by the foreign demand shock under a fixed exchange rate regime. The accumulated responses of between-countries income gap under both exchange rate regimes can be explained by the fact that as shown in Figure 5.1a, higher economic growth under a flexible exchange rate regime plays a role in reducing the income gap more than under a fixed exchange rate regime.

To conclude, a fixed exchange rate regime is better than a flexible exchange rate regime in stabilising the output, price level and real exchange rate to a negative foreign demand shock. However, in terms of accumulated value, a flexible exchange rate regime generates higher economic growth, lower inflation and more income equality compared to a fixed exchange rate regime when a country is hit by a negative foreign demand shock.

ii. World real oil price shock

Figure 5.2 below shows the impulse responses and accumulated impulse responses of real GDP, CPI, real exchange rate and between-countries income gap to a positive one standard deviation world real oil price shock under a fixed and flexible exchange rate regime.

Figure 5.2a shows the response of real output to a positive world real oil price shock. Consistent with the findings reported by Al-Abri (2013), the economic growth suffers more from the shock under a flexible exchange rate regime than under a fixed exchange rate regime. A good example of this is when the shock results in 0.02 higher economic growth under a fixed exchange rate regime, but 1.06% less economic growth under a flexible exchange rate regime. The real output contraction under a flexible exchange rate lasts for five years after the shock commenced. However, the shock has a negligible impact on real output under a fixed exchange rate regime compared with the impact under a flexible exchange rate regime.

The accumulated impulse response of real output to the world real oil price shock indicates that the shock stimulates output growth under a fixed exchange rate regime. In contrast, the shock leads to accumulated contraction in real output under a flexible exchange rate regime. Higher economic growth under a fixed exchange rate regime is possible because most observations are from Malaysia and Brunei which are net oil exporters. Therefore, revenues from higher oil prices will boost the real output growth.

The behaviour of real output under a flexible exchange rate regime can be explained that the increase in oil price leads to an increase in production costs which in turn triggers inflation. The inflation results in the erosion of purchasing power and this situation curtails demand and economic growth ceases (Raghavan 2015).

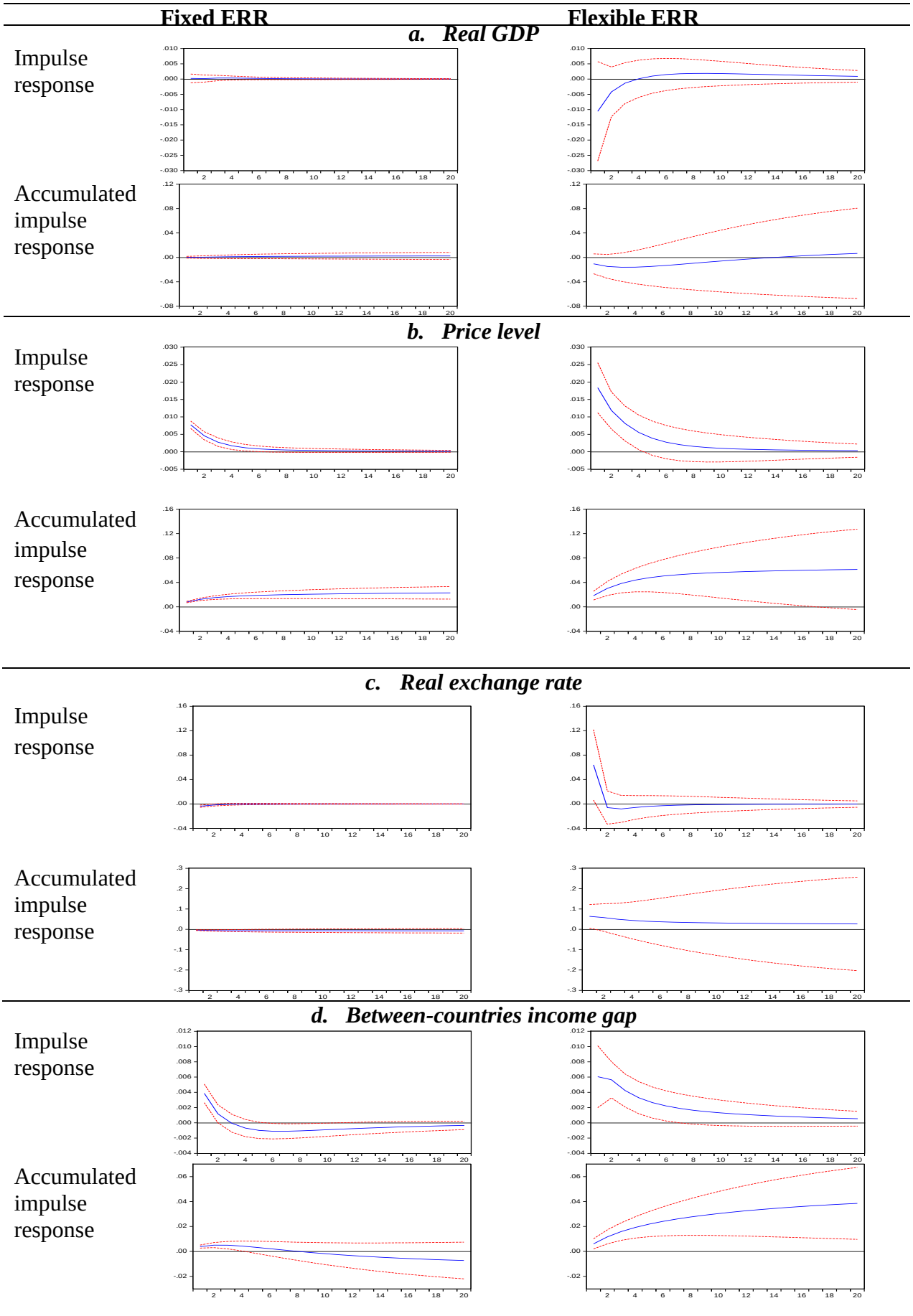


Figure 5.2: Impulse response of a positive world real oil price shock

Figure 5.2b indicates that the positive world real oil price shock results in an immediate higher price under both exchange rate regimes. However, the effect of the shock on prices lasts longer under a flexible exchange rate regime. To illustrate this, the effect gradually dissipates after 5 years under a fixed exchange rate regime but it is 11 years under a flexible exchange rate regime. In terms of accumulated impacts, ASEAN countries under both exchange rate regimes also suffer from higher price level resulting from a world real oil price shock. As explained above, an increase in the world real oil price leads to rising price level because production costs have increased.

The effect of an increase in world real oil price on inflation under a fixed exchange rate regime is less than under a flexible exchange rate regime. This is because inflation is affected by an increase in the oil price under a fixed exchange rate regime whereas it is affected by both an increase in the oil price and higher import costs coming from domestic currency depreciation. In other words, the price level in a flexible exchange rate regime is affected by higher price of imported goods and higher price of domestically produced goods. Meanwhile, the price level in a fixed exchange rate regime is only affected by higher price of domestically produced goods. Additionally, most of observations in this study under a fixed exchange rate regime are from Brunei and Malaysia which are net oil exporters and hence, their price level is less affected by an increase in world real oil price. These result in higher inflation under a flexible than under a fixed exchange rate regime.

Furthermore, higher inflation under a flexible exchange rate regime leads to a greater loss of competitiveness and reduced more demand for domestic goods under a flexible exchange rate regime. It means that real output will be more affected by a world real oil price shock under a flexible exchange rate regime.

It can be seen from accumulated responses of price level and real output that under a flexible exchange rate regime, higher price level due to the world real oil price shock is

accompanied by a reduction in real output. This can be explained that under a flexible exchange rate regime, the positive world real oil price shock boosts foreign currency demand which puts downward pressure on the domestic currency. This increase costs of production in terms of domestic currency and lead to the reduction in firm's output (Jin 2008). In addition, higher price level coming from a positive world real oil price and domestic currency depreciation leads to the deferral of individuals and households in buying goods and services and investment which then leads to output contraction (Ahmed & Wadud 2011). Under a fixed exchange rate regime, the more stability of exchange rate plays a role in stabling the accumulated price level and hence, the world real oil price shock seems have a little impact on real output.

Figure 5.2c shows that under both exchange rate regimes, a positive world real oil price shock results in real depreciation. The oil price shock wields a more significant effect on real exchange rate under a flexible than under a fixed exchange rate regime. A good example is that domestic currency appreciates 0.37% under a fixed regime but depreciates 6.4% under a flexible regime. Notably, despite the increase in the price level under a flexible exchange rate regime, the domestic currency still depreciates. This is because the real exchange rate is also affected by the increase in foreign price level as a result of a positive world real oil price shock. Therefore, changes in real exchange rate under a flexible exchange rate regime depend on how the domestic price changes relative to foreign price. Additionally, real exchange rate is more volatile under a flexible than under a fixed exchange rate regime because the price level increases more strongly under a flexible than under a fixed exchange rate regime.

Figure 5.2d illustrates the responses of between-countries income gap to a positive world real oil price shocks under a fixed and a flexible exchange rate regime. A positive world real oil price increases contemporaneously between-countries income gap under both exchange rate regimes. However, the gap starts to decrease in the sixth year under a

fixed exchange rate regime. Under a flexible exchange rate regime, the gap continues to increase until the effects of the shock becomes less significant as time passes. In terms of accumulated value, the world real oil price shock results in increases in between-countries income gap under both exchange rate regimes. Higher income gap between-countries can be explained that ASEAN includes oil exporters and oil importers and hence, higher world real oil price creates more income for oil exporters but more expenses for oil importers. This leads to greater income gap between ASEAN countries.

The gap is wider under a flexible rather than a fixed exchange rate regime. Following Nenova (2004), the lower volatility of the price level and real exchange rate to a positive world real oil price shock under a fixed exchange rate regime in relation to a flexible one promotes private investment, productivity and output growth. In turn this generates a smaller between-countries income gap under a fixed than under a flexible exchange rate regime. Moreover, most of the observations in a flexible exchange rate regime are oil-importing countries (which have more expenditure because of a higher oil price) whereas most of the observations in a fixed exchange rate regime are oil-exporting countries (which have revenue from higher oil price). Therefore, between-countries income gap is greater under a flexible exchange rate regime compared with under a fixed exchange rate regime.

In summary, it can therefore be seen that the world real oil price shock has serious consequences for economic activities under both exchange rate regimes because it cause lower economic growth, higher inflation and greater between-countries income gap. This finding is consistent with Basnet and Upadhyaya (2015) who indicate that ASEAN countries are oil-importing nations which are negatively affected by a world real oil price shock. In addition, a fixed exchange rate regime is better than a flexible exchange rate regime in coping with a positive world real oil price shock because under a fixed exchange rate regime, real output, the price level and the real exchange rate are more stable. Furthermore, a country with a flexible exchange rate regime suffers more from lower

economic growth, higher inflation and greater between-countries income gap compared to a country with a fixed exchange rate regime.

iii. Foreign real interest rate shock

Figure 5.3 demonstrates the impulse responses and accumulated impulse responses of real GDP, CPI, real exchange rate and between-countries income gap to a negative one standard deviation foreign real interest rate shock under a fixed and flexible exchange rate regime. Similar to Zhang *et al.* (2014), the positive foreign real interest rate shock has a positive contemporaneous effect on GDP under a flexible exchange rate regime. This is explained via exchange rate channel that real depreciation boosts exports and then economic growth of ASEAN countries. The adjustment of real output to a foreign real interest rate shock in Figure 5.3a is more volatile under a flexible than under a fixed exchange rate regime. Real output declines contemporaneously by 0.004% under a fixed regime but it is 2.1% increase under a flexible regime.

In term of accumulate value, the shock leads to real economic growth contraction under a fixed exchange rate regime but real economic growth expansion under a flexible exchange rate regime. This finding is consistent to Di Giovanni and Shambaugh (2008) who found that higher foreign interest rate has a contraction impact on real economic growth but just in case under a fixed exchange rate regime. The accumulated response of real output to a foreign real interest rate shock under a fixed exchange rate regime shows that the shock triggers a minor problem for real output. Nonetheless, the shock has a larger positive accumulated impact on GDP under a flexible exchange rate regime. The larger reaction of output to a foreign real interest rate shock under a flexible exchange rate regime can be explained as follows. Under a flexible exchange rate regime, an increase in the foreign real interest rate leads to capital outflow. A consequence of this is a nominal domestic currency depreciation which stimulates output. Nonetheless, under a fixed exchange rate regime, the effect of a foreign real interest rate shock on output is limited. It

is because capital outflows will result in balance of payments deficits which put downward pressure on the currency which will be met by a decline in the money supply. This will push down prices and increase the domestic interest rate, which will have both positive and negative impacts on GDP, respectively. Hence, the impact is probably more clear-cut with a flexible exchange rate.

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The contemporaneous impact of a foreign demand shock on the price level depicts a decline under a flexible exchange rate regime but small increase under a fixed exchange rate regime. The accumulated effect of a positive foreign interest rate on price level in countries with fixed exchange rate regime is insignificant compared with the response under the flexible exchange rate regime. Under a flexible exchange rate regime, the shock leads to an accumulated decrease in inflation. This can be explained as follows. Real interest rate is the difference between nominal interest rate and inflation rate. International Fisher effect stated that domestic real interest rate equals foreign real interest rate. Hence, assuming no change in the domestic nominal interest rate, inflation will be lower when foreign real interest rate increases.

Figure 5.3c compares the responses of real exchange rate to the foreign real interest rate shock between a fixed and a flexible exchange rate regime. The contemporaneous impact of the shock on the real exchange rate under a fixed exchange rate regime is insignificant because the price level is sticky in the short-run and the nominal exchange rate does not change. Under a flexible exchange rate regime, a positive foreign real interest rate shock increases net capital outflow. This results in an increase in foreign currency demand and domestic currency depreciation. This causes real depreciation. Similar to Zhang *et al.* (2014) and Hoffmann (2007), real exchange rate regime is larger volatility to the foreign real interest rate shock under a flexible exchange rate regime. This is because in the short-run, the price level is sticky while the nominal exchange rate responds faster and stronger.

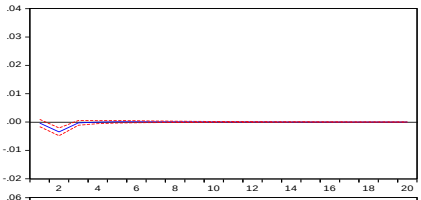
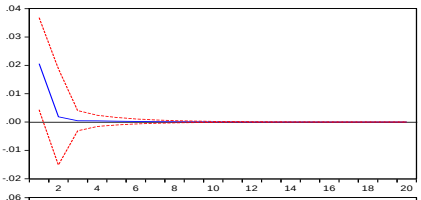
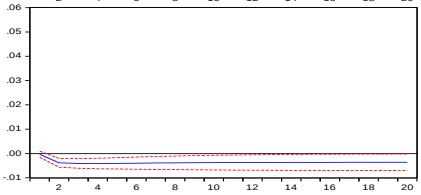
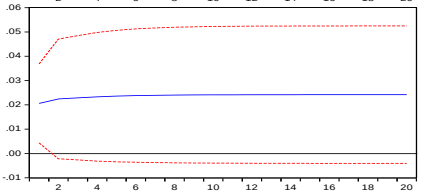
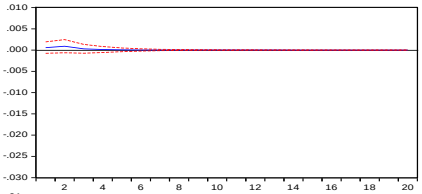
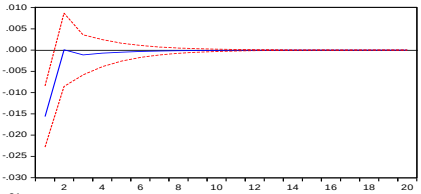
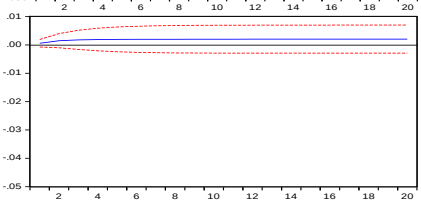
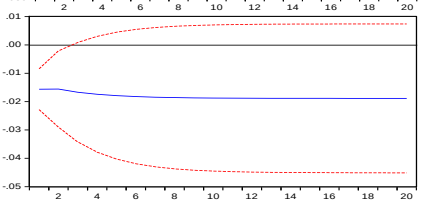
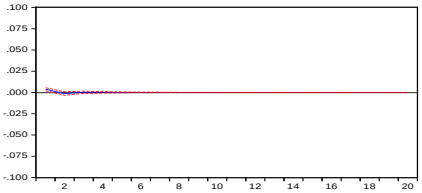
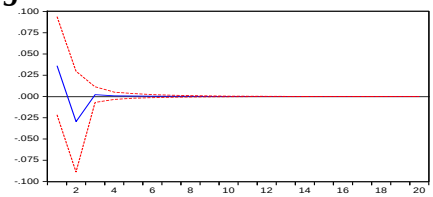
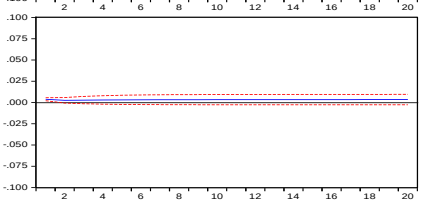
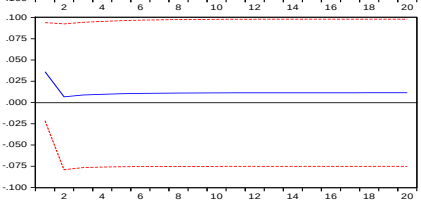
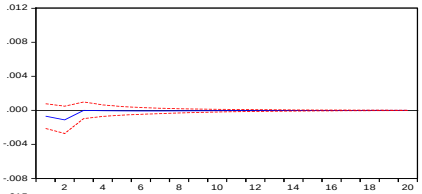
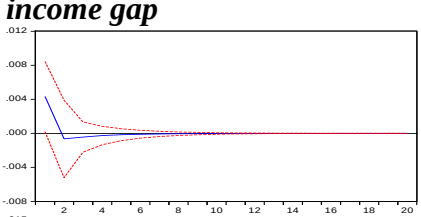
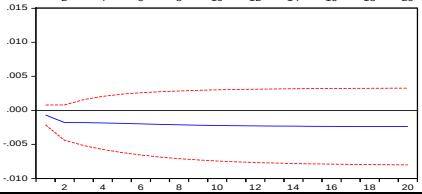
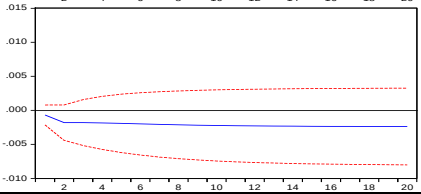
Type of shock	Fixed ERR	Flexible ERR
	a. Real GDP	
Impulse response		
Accumulated impulse response		
	b. Price level	
Impulse response		
Accumulated impulse response		
	c. Real exchange rate	
Impulse response		
Accumulated impulse response		
	d. Between-countries income gap	
Impulse response		
Accumulated impulse response		

Figure 5.3: Impulse response of a positive foreign real interest rate shock

The foreign real interest rate shock has a brief and little impact on the between-countries income gap in countries with a fixed exchange rate regime. Therefore, it can be confidently asserted that the foreign real interest rate shock seems to have small impact on the gap under a fixed exchange rate regime. Nonetheless, under a flexible exchange rate regime, the foreign real interest rate shock increases the gap contemporaneously, followed by a decrease in the second year after the shock. The effect of the shock is short-lived and completes in the third year.

The contemporaneous behaviour of the between-countries income gap can be explained as follows. As indicated previously, ASEAN countries' debt is mainly in foreign currency and hence, under a fixed exchange rate regime higher foreign real interest rate increases interest payment of net borrowing countries (generally, they are lower income countries) and interest yield of net lending countries (generally, they are higher income countries). This leads to higher income gap between ASEAN countries. Similarly, under a flexible exchange rate regime, a positive foreign real interest rate widens between-countries income gap. However, between-countries income gap under flexible exchange rate regime is more affected by the shock compared to that under a fixed exchange rate regime. This is because greater interest payment/yield under a fixed exchange rate regime only results from higher foreign real interest rate while under a flexible exchange rate regime, it is caused by both higher foreign real interest rate and depreciation.

Regarding to cumulative value, the foreign real interest rate shock has a trivial accumulated impact on the gap under a fixed exchange rate regime compared with the impact under a flexible exchange rate regime. Although the foreign real interest rate shock leads to an accumulated decrease in between-countries income gap under a flexible exchange rate regime, this decrement is limited. The muted influences of a positive foreign real interest rate shock on between-countries income gap is because most financial markets in ASEAN countries have not been not completely liberalised and integrated into the world

financial market. Therefore, higher foreign real interest rate does not affect significantly income of ASEAN countries.

iv. Comparisons between the effects of external shocks

From the results of impulse responses, we find that the short-run effects of all types of external shocks under a flexible exchange rate regime are greater than that under a fixed exchange rate regime. Furthermore, under both exchange rate regimes, the external shocks have unremarkable effects on variables in the long-run. In addition, the external shocks have more prolonged effects on variables under a flexible than under a fixed exchange rate regime. Moreover, a foreign demand shock and world real oil price shock have long-lasting impacts whereas the effect of the foreign real interest rate shock is short-lived. This means that the trade channel does have a critical influence whereas foreign monetary policy exerts only a weak impact on ASEAN countries under both a fixed and flexible exchange rate regime.

Table 5.3 below presents summary responses of variables to a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock under a fixed and a flexible exchange rate regime. This study also examined whether the effects of shocks on macroeconomic variables are symmetric or asymmetric by comparing the responses of real GDP between negative and positive shocks. As indicated by Broda (2004), there may be an asymmetric response to positive and negative shocks within exchange rate regimes. A good example is that under a fixed regime, there might be larger stickiness of prices when prices are required to decrease than when they have to increase. Hence, the adjustment of output to positive shocks should be smoother than to negative shocks because the ease with which relative prices change. The results which are presented in Figure D6, Appendix D show that shocks have symmetric impacts.

Table 5.3: Summary comparison of the responses from the between-countries income gap model

Type of shock	Contemporaneous response				Responses		Accumulated responses		
	Decrease	Increase	Negligible	More fluctuated	Short-lived	More prolonged	Decrease	Increase	Negligible
Real GDP									
Foreign demand	Fixed, flexible			Flexible	Fixed	Flexible	Flexible (Short-run)	Flexible (Medium and long-run)	Fixed
World real oil price	Flexible		Fixed				Flexible		
Foreign real interest rate		Flexible			Fixed Flexible			Flexible	
Real exchange rate									
Foreign demand		Flexible	Fixed	Flexible	Fixed	Flexible		Flexible	Fixed
World real oil price									
Foreign real interest rate					Fixed Flexible				
CPI									
Foreign demand	Fixed, flexible			Flexible	Fixed	Flexible	Flexile, Fixed		
World real oil price		Fixed, flexible						Flexible	
Foreign real interest rate	Flexible	Fixed			Fixed Flexible		Flexible		Fixed
Between-countries income gap									
Foreign demand		Flexible, Fixed		Fix			Flexible	Fixed	
World real oil price	Fixed, flexible						Fixed (Long-run)	Flexible	
Foreign real interest rate	Fixed	Flexible		Flexible	Fixed Flexible		Fixed, flexible		

Source: Author

5.4.2. Variance decomposition

This section presents the variance decomposition of real GDP, CPI, real exchange rate and between-countries income gap under fixed and flexible exchange rate regimes. The variance decomposition shows the contribution of each shock on the forecast error variance of the variables. Following Chia *et al.* (2012), the short-run refers to the first period after the shock. The medium-run covers two to five years after the shock. The long-run is described as five years and more. The results of variance decomposition are presented in Table 5.4 below.

Table 5.4: Variance decomposition (%) based on a baseline model

	Fixed exchange rate regime				**Flexible exchange rate regime**			
	Real GDP	CPI	Real exchange rate	Between-countries income gap	Real GDP	CPI	Real exchange rate	Between-countries income gap
Foreign demand shock (negative)								
Short-run	4.58	39.10	21.23	0.53	0.04	8.60	0.52	0.02
Medium-run	3.78	45.60	20.14	2.37	0.06	9.51	0.64	7.02
Long-run	3.90	45.57	20.35	6.01	0.09	9.92	0.65	7.39
World real oil price shock (positive)								
Short-run	0.05	77.40	9.54	21.08	0.99	14.32	2.85	5.10
Medium-run	0.36	76.52	8.60	14.04	1.10	16.11	2.91	11.67
Long-run	0.47	75.73	8.60	17.03	1.36	16.43	2.93	13.77
Foreign real interest rate shock (positive)								
Short-run	0.18	0.43	10.55	0.52	3.71	10.54	0.92	2.56
Medium-run	11.45	1.02	7.62	1.31	3.54	6.75	1.50	2.10
Long-run	11.42	1.02	7.55	1.27	3.54	6.66	1.50	2.09

Source: Author

In Table 5.4 it can be seen that under a fixed exchange rate regime, a foreign demand shock is the most important factor in explaining the variance of short-run real output compared with the remaining shocks. In particular, a negative foreign demand shock explains 4.58% of the fluctuation of economic growth in the short-run, respectively while it is less than 0.2% in the remaining shocks. This suggests that compared with the other two types of shocks, foreign demand is the most important external driver of the growth in the short-run under a fixed exchange rate regime.

Economic growth is driven more by a foreign demand shock under a fixed exchange rate regime than under a flexible exchange rate regime. Compared with a flexible exchange rate regime, a fixed exchange rate regime stimulates international trade for ASEAN countries because it creates greater certainty for exporters and importers. In addition, some ASEAN countries are pursuing export-led growth policy. Therefore, foreign demand becomes more important to the behaviour of growth under a fixed than under a flexible exchange rate regime.

A foreign interest rate is a major driver of long-run economic growth for countries with a fixed exchange rate regime. It is also a main factor for the volatility of economic growth of countries with a flexible exchange rate regime. About 12% of the volatility of growth in the long-run in a fixed exchange rate regime is explained by a positive foreign real interest rate shock. Under a flexible exchange rate regime the foreign real interest rate shock is responsible for about 3-4% fluctuation of economic growth. The increasing contribution of a foreign real interest rate shock on the fluctuation of real output under a fixed exchange rate regime (from 0.18% in short-run to 11.42% in long-run) indicates that financial linkages are becoming more important in transmitting the financial external shock to ASEAN economies with a fixed exchange rate regime.

The importance of the foreign interest rate in driving economic growth of ASEAN

countries can be explained as follows. FDI is defined as a capital flow that moves to countries that have higher rate of return compared with world interest rate (Siddiqui & Aumeboonsuke 2014). By implementing policies to attract FDI, FDI becomes one of the major drivers of economic growth throughout ASEAN. Hence changes in foreign interest rate affect the flow of FDI which plays an important role in economic growth of ASEAN countries. As shown by Iacoviello and Navarro (2018), higher foreign interest rate decreases income and expenditures abroad which then results in lower foreign demand for imported goods and subsequently domestic GDP shrinks. Therefore, given that approximately 75% of ASEAN's trade is with extra-ASEAN countries and the importance of trading channels, a positive foreign real interest rate shock becomes an important source of economic growth.

Table 5.4 shows that a positive foreign real interest rate shock explains a higher proportion of forecast errors in economic growth under a fixed exchange rate regime than under a flexible exchange rate regime. This implies that economic growth of countries with fixed exchange rate regime is more driven by the foreign real interest rate shock compared to that of countries with flexible one. This is because a fixed exchange rate regime brings more certainty to investors than a flexible one. Therefore, a fixed exchange rate regime promotes more FDI inflow, which is a better driver of growth in ASEAN countries than a flexible exchange rate regime. Therefore, a positive foreign real interest rate shock affects FDI inflow and economic growth. As a result, it becomes more important in driving economic growth under a fixed than under a flexible exchange rate regime.

In addition, due the certainty in repayment in terms of domestic currency, a fixed exchange rate regime rather than a flexible one encourages borrowing in terms of foreign currency, which contributes to the behaviour of investment and economic growth. As a result, foreign real interest rate, which affects the interest rate of foreign currency borrowing, becomes a more important source for the behaviour of growth under a fixed

than under a flexible exchange rate regime.

Compared to other types of shocks, uncertainty in the world real oil price becomes the most important factor driving the variation of the price level under both exchange rate regimes. A good example is that a positive world real oil price shock explained about 80% of the fluctuation of the price level under a fixed exchange rate regime whereas the contribution of the remaining types of shocks on the volatility of the price level is lower, about 45% and just 1% for the cases of foreign demand and world real interest rate shocks, respectively. Similarly, about 14-16% of the fluctuation of the price level under a flexible exchange rate regime is explained by a positive world real oil price shock whiles just 6-10% with the remaining shocks.

The world real oil price is more important for the fluctuation of real exchange rate regime under a fixed compared to a flexible exchange rate regime[57]. The real exchange rate under a fixed exchange rate regime is driven by the domestic price level whereas it is driven by both domestic price level and nominal exchange rate under a flexible exchange rate regime. As mentioned previously, ASEAN countries have a low degree of input substitution between imported input and domestic input. Therefore, the increase in price level as a result of higher imported input price coming from the effect of the shock offsets the effect of the shock on nominal exchange rate. Thus the real exchange rate regime under a fixed exchange rate regime is propelled more by the shock than under a flexible one.

Furthermore, it plays a greater role in explaining the fluctuation of between-countries income gap compared to the remaining shocks. In particular, it is responsible for 10-20% of the variation of the gap under both exchange rate regimes. The world real oil price shock wields the greatest impact on ASEAN economies. This is because the ASEAN countries are: firstly, very intensive in their production of oil; secondly, very trade

[57] The same circumstance can be seen in a negative foreign demand shock and a positive foreign real interest rate shock.

intensive; and thirdly, highly integrated into global production chains (Downes 2007).

Table 5.6 presents a summary of the contribution to fluctuations of each key variable for the major shocks for each type of exchange rate regime.

Table 5.5: Summary of the shock that has the greatest contribution under a fixed and flexible exchange rate regime

Variables	**Fixed**			**Flexible**		
	Short -run	Medium-run	Long-run	Short -run	Medium-run	Long-run
Real GDP	Foreign demand shock	Foreign real interest rate shock		Foreign real interest rate shock		
CPI	World real oil price shock			World real oil price shock		
Real exchange rate	Foreign demand shock					
Between-countries income gap	World real oil price shock					

Source: Author

5.4.3. Robustness test

This section presents the results from the robustness test. Following Bhuiyan (2012), we implement the robustness test, that is changing restrictions in the contemporaneous matrix. There are two ways to impose the contemporaneous matrix regarding the order of the price level and real exchange rate. In particular, Zaidi *et al.* (2013) assumed that the real exchange rate is affected contemporaneously by inflation. However, Chia *et al.* (2012), Broda (2004) and Zhang *et al.* (2014) impose the restriction that the real exchange rate has a contemporaneous impact on inflation. Hence, to test the robustness of the results, in this section, the order of the price level and real exchange rate in the contemporaneous matrix is changed. In particular, the real exchange rate has a contemporaneous effect on the price level but the price level does not contemporaneously affect the real exchange rate. The

results are illustrated in Figure D4 in Appendix D.

Based on the result of the robustness tests the impulse responses and accumulated impulse responses are similar to those from the original model. In particular, real GDP, the real exchange rate and price level fluctuate more to shocks under a flexible exchange rate compared to the fixed exchange rate regime. The response of the between-countries income gap to shocks is also stronger under a flexible exchange rate regime. It is also evident that external shocks, except a foreign demand shock, make a small and temporary impact on variables under a fixed exchange rate regime. Moreover, the shocks result in more prolonged and more immediate effects on variables under a flexible exchange rate regime. The effect of a foreign real interest rate shock on variables under a flexible exchange rate regime is short-lived. Finally, a positive world real oil price shock has negative impacts on the economy with a flexible exchange rate regime such as output contraction, higher price level, a real depreciation and a larger income gap with other countries.

5.5. CONCLUDING REMARKS

This chapter has investigated and compared the behaviour of real output, the real exchange rate, price level and between-countries income gap from various types of shocks under fixed and flexible exchange rate regimes. The results of lag selection indicated that 1 lag was to be used. We used these lag lengths to test for the exogeneity of external shocks. The results revealed that all external shocks are not affected by domestic variables. Therefore, external shocks are treated as exogenous variables in the SVAR model.

The immediate movement of variables resulting from external shocks under a flexible exchange rate were far larger than those under a fixed exchange rate regime. In addition, the external shocks have more prolonged effects on variables under a flexible than under a fixed exchange rate regime. Under both exchange rate regimes, the external

shocks have a minor long-run impact on variables. The negligible impacts of external shocks on variables under a fixed exchange rate regime suggest that the influence of external shocks is less under such an exchange rate regime than under a flexible exchange rate regime. We subsequently conclude that a fixed exchange rate regime is better than a flexible exchange rate regime in reducing the instability of real output, the price level and real exchange rate.

However, in terms of cumulative value, a flexible exchange rate regime is superior in generating higher economic growth, low inflation as a result of a negative foreign demand shock and a positive foreign real interest rate shock. A fixed exchange rate regime is better than a flexible one in coping with a positive world real oil price shock because it generates higher economic growth and lower inflation compared to a flexible exchange rate regime.

In terms of between-countries income gap the results of accumulated responses indicate that a flexible regime is better in narrowing the income gap between ASEAN countries if the shock is a foreign demand shock. Similarly, for both exchange rate regimes, the between-countries income gap was not affected considerably by the positive foreign real interest rate shock. An increase in world real oil price widened the between-countries income gap under a fixed and a flexible exchange rate regime, with greater gap under the latter regime.

By comparing the effect of shocks on variables, we find that under both exchange rate regimes all types of shocks have minor long-run impact on variables. In addition, the short-run effects of external shocks are greater under a flexible than under a fixed exchange rate regime. The effects of external shocks are more prolonged under a flexible than under a fixed exchange rate regime. In general, the effects of foreign demand and world real oil price shocks are long-lasting whereas a foreign real interest rate shock only has a short-lived impact. This suggests that trade channel has a greater impact on ASEAN

economies compared with foreign monetary policy.

Results of variance decomposition indicated that foreign demand is the main driver for short-run economic growth under a fixed exchange rate regime. However, long-run economic growth is mainly driven by the foreign real interest rate shock. In addition, world real oil price shock is the dominant source for the fluctuation of the price level and real exchange rate under both exchange rate regimes. Under both exchange rate regimes this shock explains the largest portion of the volatility of the between-countries income gap.

To test the robustness of the results, we changed the order of the variables in the contemporaneous matrix. The results were consistent with the results of the original model. This implies that the original model is robust. Another aim of this study is to investigate the impact and contribution of external shocks to the within-country income gap under fixed and flexible exchange rate regimes. The following chapter presents the empirical results for the within-country income gap model.

CHAPTER 6: EMPIRICAL RESULTS FOR THE WITHIN-COUNTRY INCOME GAP MODEL

6.1. INTRODUCTION

This chapter presents the empirical results for the within-country income gap model, specifically on the effects and contribution of various types of shock, i.e. a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock on real GDP, price level, real exchange rate and within-country income gap under fixed and flexible exchange rate regimes. Like the between-countries income gap model, certain steps need to be implemented before estimating the model, namely choosing optimal lag length and stability test. In addition, a Granger causality test will be employed to examine the exogeneity of external shocks. To investigate the impacts and importance of these external shocks, we implement the impulse response function and variance decomposition. Finally, to test the robustness of our results, we conduct a sensitive analysis by changing the order of variables.

The structure of this chapter is as follows. Section 6.2 presents the lag length selection and stability check. The test for exogeneity of external shocks is described in Section 6.3. Section 6.4 discusses the empirical results for the impulse response and variance decomposition, and robustness test. Finally, Section 6.5 is the conclusion.

6.2. LAG LENGTH SELECTION AND STABILITY CHECK

Similar to the model for between-countries income gap, the lag length selection and stability check will serve to find the optimal lag order for estimating the structural VAR model. As discussed in the previous chapter there are certain criteria for choosing the optimal lag length and these are LR, FPE, AIC, SC and HQ. We only consider a maximum of 7 lags because of the limited data observations. We apply the AR Characteristic

Polynomial test to examine the stability of the suggested lag length. The results for the optimal lag length are presented in Table 6.1.

Table 6.1: Results of optimal lag length

	LR	FPE	AIC	SC	HQ
Foreign demand shock					
1 lag		x	x		x
5 lags	x				
World real oil price shock					
1 lags				x	x
7 lags	x	x	x		
Foreign real interest rate shock					
1 lag					x
7 lags	x	x	x		

Source: Author

In terms of a foreign demand shock, 1 lag is selected by the FPE and AIC criteria while the LR criterion chooses two lags. We select 1 lag as an optimal lag length because more criteria select 1 lag rather than 5 lags. This lag length also satisfies the condition for stability[58].

From Table 6.1, it can be seen that in the model with a world real oil price shock, the SC and HQ criteria select 1 lag whereas 7 lags are chosen by the LR, FPE and AIC criteria. Using the AR Characteristic Polynomial test, we find that the model with 7 lags does not satisfy the requirement for stability. However, this condition is satisfied in the case of 1 lag[59]. Therefore, 1 lag will be selected for estimating SVAR.

Table 6.1 also presents the results for the chosen lag length regarding a positive foreign real interest rate shock. At first, seven lags are chosen by all of the criteria when

[58] See Table E1 and Figure E1 in Appendix E.
[59] See Table E2 and Figure E2 in Appendix E.

we include the maximum of 7 lags. However, the model with 7 lags does not satisfy the stability condition. The model with 1 lag satisfied this condition[60]. Therefore, the model with a foreign real interest rate shock will be estimated utilising 1 lag.

In summary, 1 lag length will help to estimate the model with foreign demand, world real oil price and foreign real interest rate shocks.

6.3. EXOGENEITY OF EXTERNAL SHOCKS

In this section, we conduct the Granger causality test to test for the exogeneity of external shocks. The results of the Granger causality test are summarised in Table 6.2. The null hypotheses are that variables, namely real GDP, CPI, real exchange rate and within-country income gap do not Granger-cause external shocks.

Table 6.2: Granger causality test for the within-country income gap model

	Chi-sq	**Prob.**
1. Foreign demand with 1 lag		
Real GDP does not Granger cause foreign demand	0.06	0.8033
CPI does not Granger-cause foreign demand	2.97	0.0849
Real exchange rate does not Granger-cause foreign demand	0.33	0.5659
Within-country income gap does not Granger-cause foreign demand	1.40	0.2363
2. World real oil price with 1 lag		
Real GDP does not Granger-cause world real oil price	0.05	0.8146
CPI does not Granger-cause world real oil price	1.60	0.2061
Real exchange rate does not Granger-cause world real oil price	0.15	0.7025
Within-country income gap does not Granger-cause world real oil price	1.94	0.1632
3. Foreign real interest rate shock with 1 lag		
Real GDP does not Granger-cause real foreign interest rate	0.22	0.6399
CPI does not Granger-cause real foreign interest rate	2.22	0.1358
Real exchange rate does not Granger-cause real foreign interest rate	0.64	0.4254
Within-country income gap does not Granger-cause real foreign interest rate	2.12	0.1451

Source: Author

[60] See Table E3 and Table E4 and Figure E3 in Appendix E.

The results indicate that we do not reject the null hypothesis for the foreign demand, world real oil price and foreign real interest rate shocks at the 1 percent significance level. Therefore, these types of shocks are treated as exogenous.

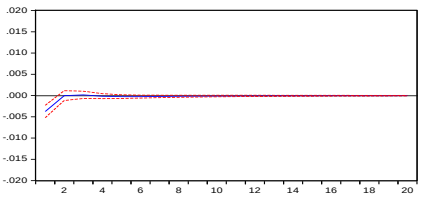
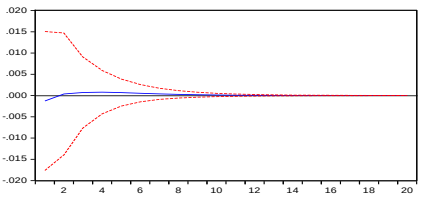
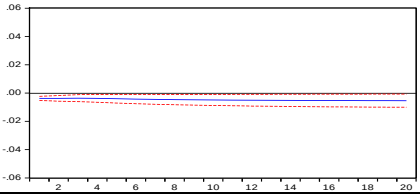
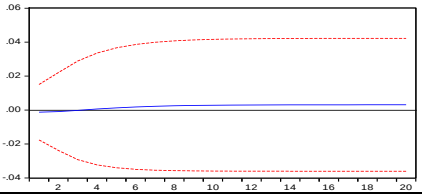
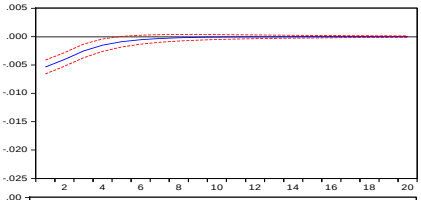
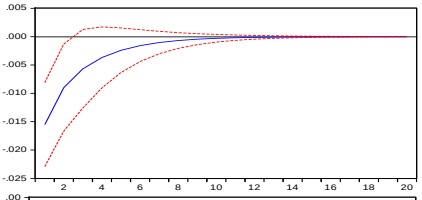
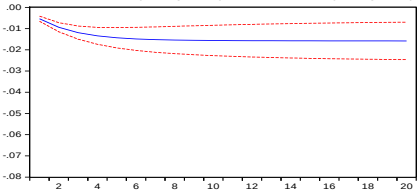
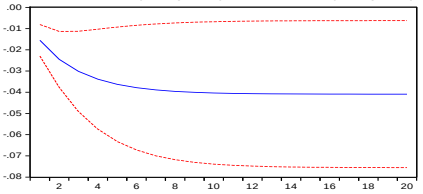
6.4. EMPIRICAL RESULTS

6.4.1. Impulse response function

To analyse the effects of external shocks, this section will examine the impulse responses of real GDP, price level, real exchange rate and within-country income gap under a fixed and flexible exchange rate regime.

i. Foreign demand shock

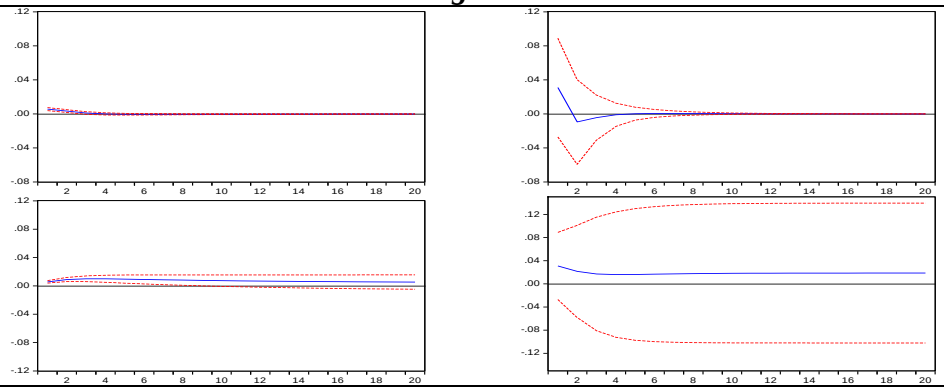
Figure 6.1 illustrates the responses and accumulated responses of real GDP, the price level, real exchange rate and within-countries income gap to a negative foreign demand shock under a fixed and a flexible exchange rate regime.

	Fixed ERR	**Flexible ERR**
	a. Real GDP	
Impulse response		
Accumulated impulse response		
	b. Price level	
Impulse response		
Accumulated impulse response		

c. Real exchange rate

Impulse response

Accumulated impulse response



d. Within-country income gap

Impulse response

Accumulated impulse response

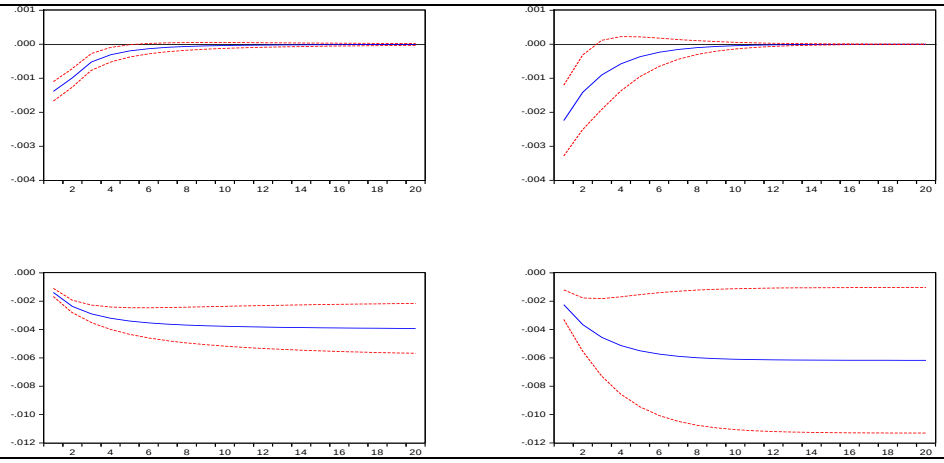


Figure 6.1: Impulse response of a negative foreign demand shock

It can be seen from Figure 6.1a that real output under a fixed exchange rate regime declines with a negative foreign demand shock for the first four years before dying out. Similar to the fixed exchange rate regime, a negative foreign demand shock leads to a contemporaneous real output contraction under a flexible exchange rate regime[61]. However, the immediate response of real output to the shock is more volatile and prolonged under this regime. For example, the effect of the shock dies out in 5 periods after the shock under a fixed exchange rate regime but 11 periods after the shock under a flexible exchange rate regime[62]. After an immediate decline, real output of countries with a flexible exchange rate regime begins an expansionary phrase in the designated time horizon.

[61] See Section 5.4.1.i for a detailed explanation of the contemporaneous real output contraction to foreign demand shock.

[62] See Table E4 and Table E5 in Appendix E.

It can be observed from the accumulated response of real output to a negative foreign demand shock that under a fixed exchange rate regime, the economy experiences a lower economic growth. Meanwhile an economy with a flexible regime also suffers from a lower economic growth, yet this outcome is brief. After the first year, the shock generates an expansionary effect for a longer period.

Regarding the reaction of the price level in Figure 6.1b, it can be seen that a foreign demand shock leads to a contemporaneous price level decrease under both exchange rate regimes, with smaller response in the fixed exchange rate regime. For instance, the price level reduces immediately by 0.5% and 1.6% under a fixed and a flexible exchange rate regime, respectively[63]. Under a fixed exchange rate regime, the price level seems to be affected slightly and for only a short period by a foreign demand shock. However, a country with the flexible regime experiences lower and more prolonged inflation than a country with a fixed regime. This finding is consistent with Shi *et al.* (2015)[64].

It can be seen from Figure 6.1c that foreign demand uncertainty has small effects on the real exchange rate under a fixed exchange rate regime. A good example is that real exchange rate in a fixed exchange rate regime increases by just 0.56%. However, the real exchange rate is more volatile under a flexible exchange rate regime. Under a flexible exchange rate regime, the real depreciation with 3.1% results from the contemporaneous effect of negative foreign demand shock[65]. However, the real exchange rate begins declining in the next year. Similarly, the shock has a greater accumulated impact on the real exchange rate under a flexible rather than a fixed exchange rate regime. In terms of cumulative value, countries with a fixed exchange rate regime experience with small real

[63] See Table E4 and Table E5 in Appendix E for detailed results.
[64] See Section 5.4.1.i for a detailed explanation of price level responding to foreign demand shock.
[65] See Table E4 and Table E5 in Appendix E for detailed results.

depreciation whereas the shock leads to larger real depreciation under a flexible exchange rate regime[66].

Figure 6.1d shows the responses of within-country income gap under a fixed and a flexible exchange rate regime. Within-country income gap increases when the solid line is above the horizontal line and vice versa. A negative foreign demand shock generates contemporaneous more income equality under both exchange rate regimes. This reaction is consistent with Lim and McNelis (2014) who found that countries with high trade openness, which is a salient feature of ASEAN countries, produce less income inequality in response to a negative export demand shock. Less within-country income inequality under both exchange rate regimes can be explained in terms of a decrease in foreign demand leading to lower incomes for people working in the tradable sector. This narrow income gap is between people working in the tradable and non-tradable sectors.

However, this positive impact under a fixed regime is shorter and negligible compared with the effect under a flexible exchange rate regime. The results of accumulated responses also indicate that a flexible exchange rate regime is better than a fixed exchange rate regime in reducing income inequality if a country is hit by a foreign demand shock. The greater reduction in income inequality under a flexible regime can be explained as being due to higher volatility of real exchange rate, capital owners find difficulties in borrowing money from foreign sources. Therefore, investment declines and this leads to capital owners having less income. Hence, income inequality between owners of capital and the workforce falls more strongly under a flexible regime compared to a fixed exchange rate regime.

Furthermore, as mentioned, following Shi *et al.* (2015), due to the foreign currency pricing on export goods of some ASEAN countries, nominal devaluation in a flexible

[66] See Section 5.4.1.i for a detailed explanation of the real exchange rate response to a foreign demand shock.

exchange rate regime do not play a role in stablising external demand. A negative foreign demand shock decreases the income of workers in the tradable sector. Moreover, the expediture-switching effect of depreciation under a flexible exchange rate regime leading to consumption of imported good is substitued by non-traded goods. This leads to an increase in incomes of people who are working in the non-trable sector. Consequently, the within-country income gap declines under a flexible exchange rate regime. Under a fixed exchange rate regime, within-country income also reduces but less so because the incomes of tradable sector workers fall while the incomes of people working in non-tradable industries remain the same.

It can be seen from Figure 6.1 that the lower price level is associated with lower income inequality under a flexible exchange rate regime. This is consistent with previous studies such as Albanesi (2007) who found there is a positive relationship between inflation and income inequality. Dolmas *et al.* (2000) also indicated countries with high levels of income inequality are likely to have higher inflation.

ii. World real oil price shock

Figure 6.2 illustrates the responses and accumulated responses of real GDP, the price level, real exchange rate and within-countries income gap to a positive world real oil price shock under a fixed and a flexible exchange rate regime.

It can be seen from Figure 6.2a that real output under a fixed exchange rate regime seems to be insignificantly affected by the world real oil price shock. However, real output is more volatile under a flexible exchange rate regime. The shock leads to a decline in real output until the first four periods, before having only a trivial effect over the long-term horizon. In terms of accumulated impulse responses, the world real oil price shock also has a negligible accumulated impact on economic growth under a fixed exchange rate regime.

Nevertheless, the economy suffers from lower economic growth under a flexible exchange rate regime[67].

Figure 6.2b shows that the response of the price level to a world real oil price shock in both exchange rate regimes is the same. In particular, a positive world real oil price triggers higher price level. The effect starts to diminish after the first year. Nonetheless, the reaction of the price level is stronger under a flexible rather than under a fixed exchange rate regime. A good example is that the price level increases instantaneously only 0.8% under a fixed regime but 1.8% under a flexible regime[68]. The accumulated responses also show that countries with a flexible exchange rate regime suffer from higher inflation than countries with a fixed exchange rate regime[69].

[67] See Section 5.4.1.ii for a detailed explanation of the real output responding to world real oil price shock.
[68] See Table E6 and Table E7 in Appendix E for detailed results.
[69] See Section 5.4.1.ii for a detailed explanation of price level responding to world real oil price shock.

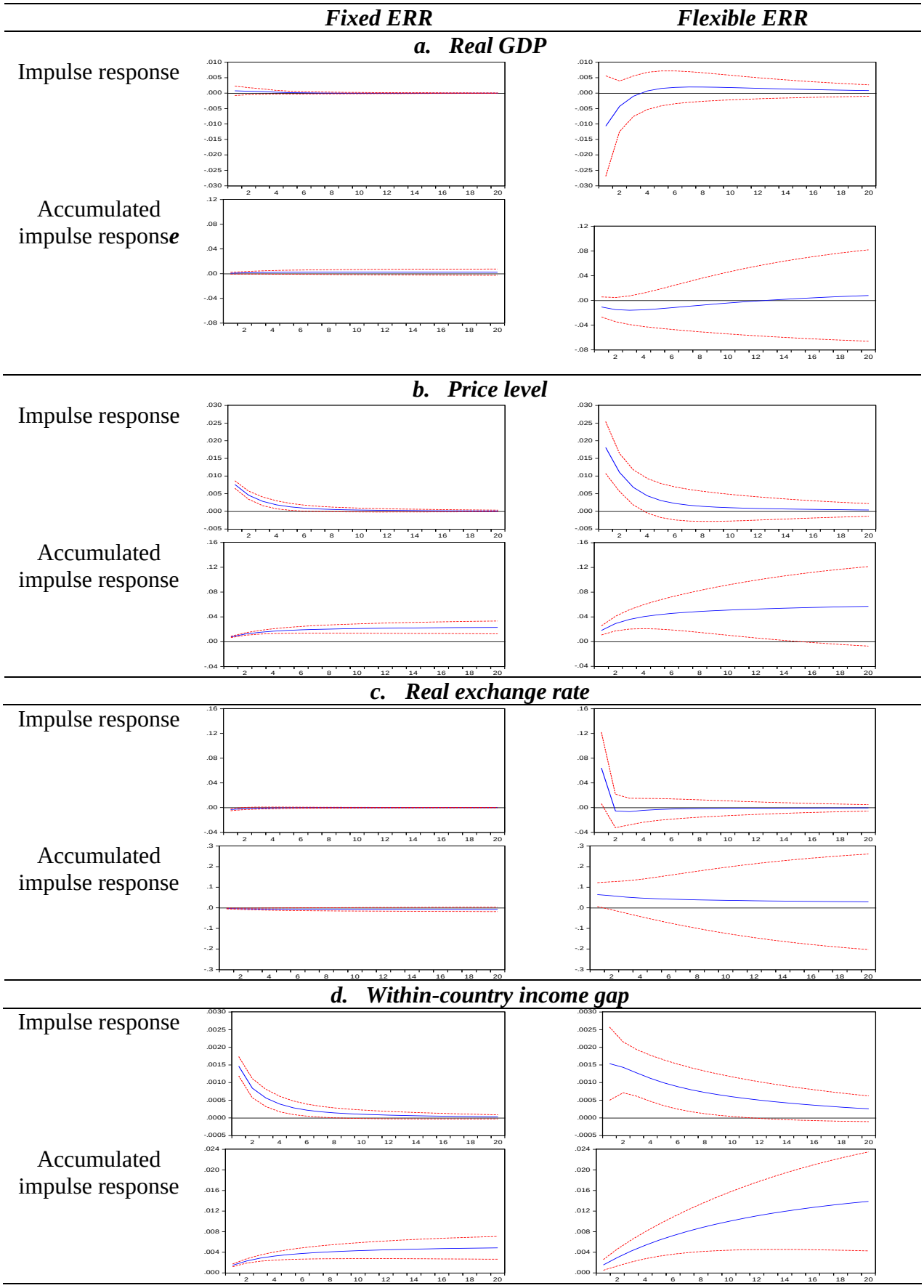


Figure 6.2: Impulse response of a positive world real oil price shock

It can be seen from Figure 6.2c that an increase in the world real oil price also has an insignificant impact on the real exchange rate under a fixed exchange rate regime compared with a flexible regime. On the contrary, the currencies of the ASEAN countries suffer from a real depreciation under a flexible exchange rate regime. Real depreciation is 6.4% under a flexible exchange rate regime whereas it is just 0.3% real appreciation under a fixed exchange rate regime[70]. The real depreciation is no longer significant after the third year, meaning that the uncertainty of a positive world real oil price shock has a very small effect on the real exchange rate in the long-run. The accumulated impulse response of the real exchange rate indicates that the shock has a lesser accumulated effect under a fixed rather than under a flexible exchange rate regime. In particular, its impact is mute under a fixed exchange rate regime while it causes a real depreciation under a flexible exchange rate regime[71].

Figure 6.2d illustrates the responses of within-country income gap to a positive world real oil price shock under a fixed and a flexible exchange rate regime. Within-country income in both exchange rate regimes becomes more unequal if the world real oil price increases. The instantaneous response to income inequality is not much different between a fixed and flexible exchange rate regime. In particular, within-country income gap increases 1.46% under fixed and 1.54% under a flexible exchange rate regime[72]. Nevertheless, the effect of such a shock under a flexible regime seems more prolonged than under a fixed exchange rate regime and, hence, the accumulated income inequality is greater under a flexible exchange rate regime than under a fixed exchange rate regime. To explain this, compared with a fixed exchange rate regime, the higher real depreciation under a flexible exchange rate regime reduces the purchasing power of poor people more because their earnings are mainly in terms of domestic currency. Moreover, they have to cope with the

[70] See Table E6 and Table E7 in Appendix E for detailed results.
[71] See Section 5.4.1.ii for a detailed explanation of the real exchange rate response to a positive world real oil price shock.
[72] See Table E6 and Table E7 in Appendix E for detailed results.

greater risk of having their asset values reduced in terms of foreign currency under a flexible exchange rate regime. This leads to the greater within-country income gap under a flexible exchange rate regime than under a fixed exchange rate regime. Additionally, as indicated in chapter 5, most of the observations under a fixed exchange rate regime are oil-exporting countries (who have revenues from higher real oil price) while the majority of observations under a flexible one are oil-importing countries (who pay more because of higher real oil price). Hence, more subsidies are spent on the poor under a fixed than under a flexible exchange rate regime. Consequently, the within-country income inequality is greater under a flexible exchange rate regime than under a fixed one.

As indicated in Section 3.5, Bulíř (2001) indicates that inflation widens the level of income inequality. According to what is illustrated in Figure 6.2, a positive world real oil price shock results in higher inflation under a flexible exchange rate regime compared to that of a fixed exchange rate regime. This leads to greater income inequality under the former regime. Furthermore, in the case of a negative foreign demand shock, a flexible regime produces higher deflation and, for this resason, the work by Bulíř (2001) confirms that greater deflation under a flexible regime leads to a correspondingly larger decrease in income inequality compared to a fixed exchange rate regime.

iii. Foreign real interest rate shock

The behaviours of real output, the price level, real exchange rate and within-country income gap to a positive foreign real interest rate shock are presented in Figure 6.3 as follows.

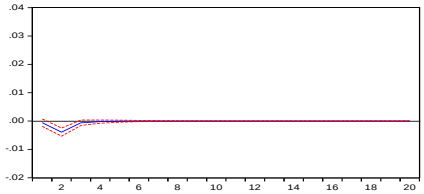
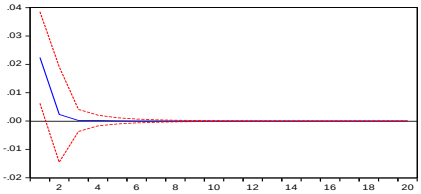
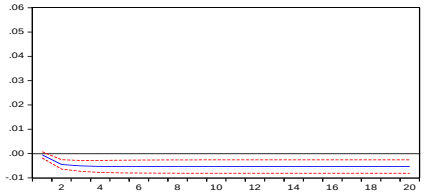
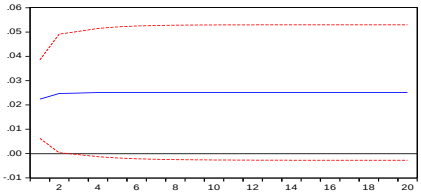
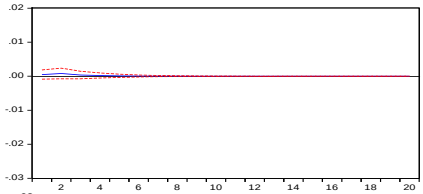
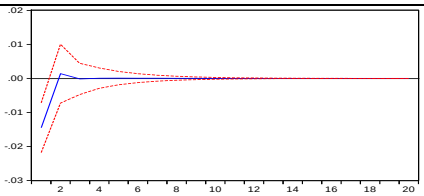
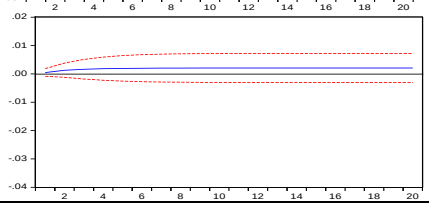
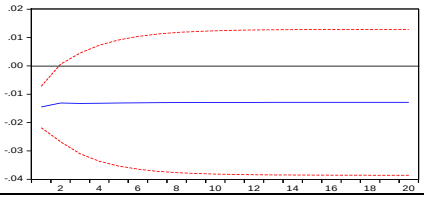
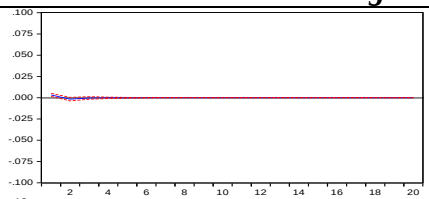
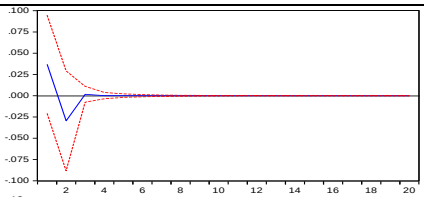
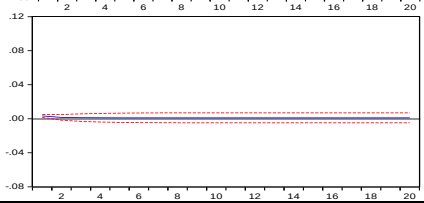
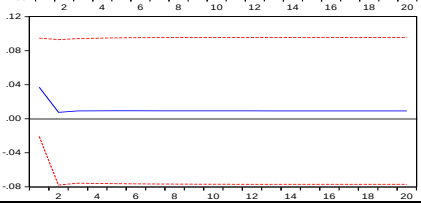
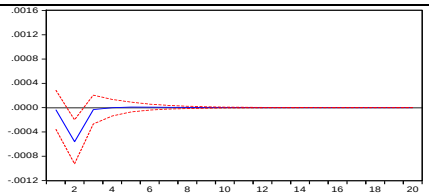
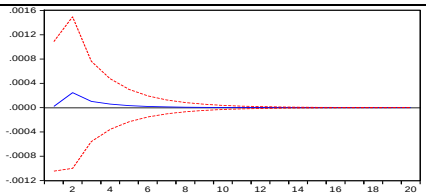
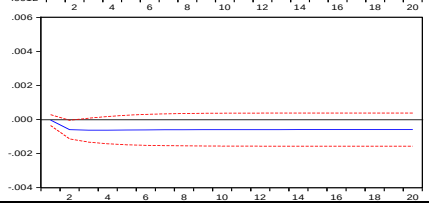
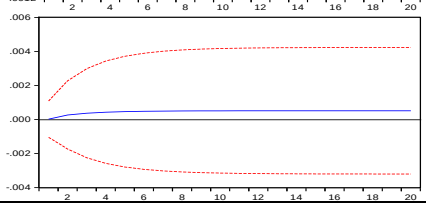
	Fixed ERR	*Flexible ERR*
	Real GDP	
Impulse response		
Accumulated impulse response		
	Price level	
Impulse response		
Accumulated impulse response		
	Real exchange rate	
Impulse response		
Accumulated impulse response		
	Within-country income gap	
Impulse response		
Accumulated impulse response		

Figure 6.3: Impulse response of a positive foreign real interest rate shock

The positive foreign real interest rate shock does not significantly affect real output under a fixed exchange rate regime, whereas real output reacts positively and strongly to the shock under a flexible exchange rate regime. For example, the shock leads to a 0.06% decrease in real output under a fixed regime, but a 2.24% increase in real output under a flexible exchange rate regime. However, the effect of the shock on real output is not long-lasting. Compared to the flexible exchange rate regime, the shock has a muted accumulated impact on output under a fixed exchange rate regime[73]. In terms of cumulative value, the shock results in poorer economic growth under a fixed but better economic growth under a flexible exchange rate regime. Di Giovanni and Shambaugh (2008) found that higher foreign real interest rate shock leads to a contraction in economic growth for ASEAN countries with a fixed exchange rate regime. The same conclusion was reached by AbuDalu *et al.* (2014).

Similarly, the price level is more stable to a foreign real interest rate shock under a fixed compared to a flexible exchange rate regime. The price level increases immediately 0.05% under a fixed regime. However, under a flexible exchange rate regime the shock leads to 1.4% lower price level. However, this effect dies out after the first year[74]. The accumulated responses of the price level suggest that a foreign real interest rate shock seems to wield an unremarkable effect on inflation under a fixed exchange rate regime. Despite the fact this type of shock generates lower accumulated inflation under a flexible exchange rate regime, it is insignificant[75].

Similar to model for between-countries income gap, a positive real foreign interest rate shock has a greater immediate effect on the real exchange rate under a flexible rather than under a fixed exchange rate regime. The shock results in 0.33% and 13.7% real

[73] See Section 5.4.1.i for a detailed explanation of the real output responding to foreign real interest rate shock.
[74] See Table E8 and Table E9 in Appendix E for detailed results.
[75] See Section 5.4.1.iii for a detailed explanation of price level responding to foreign real interest rate shock.

depreciation under a fixed and flexible exchange rate regime, respectively[76]. As explained in chapter 5, this is because an increase in foreign interest rate leads to an outflow of capital which then increases the nominal exchange rate. Under a flexible exchange rate, real exchange rate increases immediately and more strongly as a result of the increase in nominal exchange rate. However, the short-run change in real exchange rate under a fixed exchange rate regime is slower because its movement just depends on the sticky price level. The accumulated responses of the real exchange rate are also unremarkable under a fixed exchange rate regime compared with a flexible exchange rate regime. The effect of a positive foreign real interest rate shock is short-lived. Under a flexible exchange rate regime, real appreciation in terms of accumulated value is induced by a positive foreign real interest rate shock[77].

Under both exchange rate regimes, a positive foreign real interest rate shock has a very small and temporary impact on income inequality, lasting only for the first two years. After that, the shock is no longer significant. Similarly, the shock has a muted accumulated effect on income inequality under both exchange rate regimes. The insignificant impact of a foreign real interest rate shock on income inequality can be explained that most of ASEAN countries have limited linkage to the international financial market (Tang 2011) and therefore, the higher foreign real interest rate shock does not affect significantly on income of domestic lenders and borrowers.

We can explain the relationship between accumulated within-country income inequality and accumulated real output in this study as follows. As mentioned in Section 3.5 regarding the early stages of economic development, a high level of inequality can hinder sustainable economic growth. Most of the ASEAN countries are developing economies and, therefore, greater income inequality leads to lower economic growth. For

[76] See Table E8 and Table E9 in Appendix E for detailed results.
[77] See Section 5.4.1.iii for a detailed explanation of the real exchange rate response to a positive foreign real interest rate shock.

example, larger income inequality in response to a world real oil price shock under a flexible exchange rate regime is associated with lower economic growth, whereas smaller income inequality is accompanied by positive economic growth under a fixed exchange rate regime. Similar results can also be observed for a negative foreign demand shock.

iv. Comparisons between the effects of external shocks

From the responses of variables to external shocks, we conclude that the similarity between external shocks (a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock) is that under both exchange rate regimes, they seem to have no significant long-run impact on variables. Also, they have larger contemporaneous impacts on variables under a flexible under a fixed exchange rate regime. They have more prolonged effects on variables under a flexible than under a fixed exchange rate regime. In terms of accumulated responses, all of these shocks have smaller impacts on variables under a fixed than under a flexible exchange rate regime. Compared to a negative foreign demand shock and a positive world real oil price shock, the effects of a positive foreign real interest rate shock on variables under both exchange rate regimes are more short-lived. This implies that the degree of international financial dependency is smaller than that of trade dependency. In addition, the degree of financial development and openness are also lower than that of international trade development and openness.

Table 6.3 below is a summary for the responses of variables to external shocks under a fixed and a flexible exchange rate regime. Similar to the model of between-countries income gap, this study also examined whether the effects of shocks are symmetric or asymmetric by comparing the responses of real GDP between negative and positive shocks. The results which are presented in Figure E6, Appendix E show that shocks have symmetric impacts.

Table 6.3: Summary comparison of responses of the within-country income gap model to exogenous shocks

Type of shock	Contemporaneous response				Responses		Accumulated responses		
	Decrease	Increase	Negligible	More fluctuated	Short-lived	More prolonged	Decrease	Increase	Negligible
Real GDP									
Foreign demand	Fixed, flexible			Fixed	Fixed	Flexible	Flexible (Short-run)	Flexible (Medium and long-run)	Fixed
World real oil price	Flexible		Fixed				Flexible		
Foreign real interest rate		Flexible			Fixed Flexible			Flexible	
Real exchange rate									
Foreign demand		Flexible	Fixed	Flexible	Fixed	Flexible	Flexible		Fixed
World real oil price								Flexible	
Foreign real interest rate					Fixed Flexible				Fixed, flexible
CPI									
Foreign demand	Fixed, flexible			Flexible	Fixed	Flexible	Flexile		Fixed
World real oil price		Fixed, flexible						Flexible	
Foreign real interest rate	Flexible	Fixed			Fixed Flexible				Fixed, flexible
Within-country income gap									
Foreign demand	Fixed, Flexible			Flexible	Fixed	Flexible	Flexible		Fixed
World real oil price		Fixed, flexible						Fixed, flexible	
Foreign real interest rate	Flexible		Fixed	Flexible	Fixed Flexible				Fixed, flexible

6.4.2. Variance decomposition

Table 6.4 illustrates the contribution of external shocks to the fluctuations of domestic variables under fixed and flexible exchange rate regimes.

Table 6.4: Variance decomposition (%) based on a baseline model

	Fixed exchange rate regime				**Flexible exchange rate regime**			
	Real GDP	CPI	Real exchange rate	Within-country income gap	Real GDP	CPI	Real exchange rate	Within-country income gap
Foreign demand shock (negative)								
Short-run	14.49	36.82	21.53	43.09	0.01	9.8	0.67	10.38
Medium-run	13.27	44.15	21.38	51.65	0.028	10.13	0.73	11.0
Long-run	13.41	44.28	21.51	51.86	0.033	10.15	0.73	11.02
World real oil price shock (positive)								
Short-run	0.58	75.26	7.23	50.65	1.01	13.32	2.86	5.05
Medium-run	1.20	75.32	6.78	54.33	1.13	14.24	2.89	12.08
Long-run	1.21	74.92	6.85	54.22	1.40	14.54	2.90	17.25
Foreign real interest rate shock (positive)								
Short-run	0.43	0.30	8.22	0.02	4.43	8.86	0.96	0.00
Medium-run	15.0	0.84	6.60	4.93	4.21	5.79	1.54	0.10
Long-run	14.94	0.85	6.59	4.91	4.20	5.71	1.54	0.10

It can be seen from Table 6.4 that similar to the model for between-countries income gap, a foreign demand shock is a main external driver for short-run economic growth of ASEAN countries. The world real oil price shock explains less than 2% of the variation of real output. This suggests that the world real oil price does not play a crucial role in determining the real output of ASEAN countries. As indicated in Chapter 5 that because of the export-led growth strategy of ASEAN countries, foreign demand shock plays an

important role in the economic growth.

The foreign demand shock is more important to explaining the fluctuation of real GDP under a fixed regime than under a flexible exchange rate regime. In the context of the former, it contributes to about 15% fluctuation of real output but only less than 1% for the latter. As explained previously, exporters and importers feel more certainty under a fixed exchange rate regime than under a flexible exchange rate regime and therefore, a fixed exchange rate regime promotes more international trade. Changes in foreign demand have a more important role in to play when explaining the fluctuation of economic growth under a fixed exchange rate regime compared to a flexible one. The rising importance of a foreign demand shock from the short-run to the long-run suggests that a foreign demand shock becomes more important for economic growth during the time horizon.

Consistent with the finding from the model for between-countries income gap, the world real oil price shock explains most of the fluctuation of the price level under both exchange rate regimes. It induces about 75% and 15% of the variation in the price level under the fixed and flexible exchange rate regimes, respectively. This suggests that the world real oil price is the important source for explaining the fluctuation of the price level of ASEAN countries. As explained earlier, the importance of world real oil price to the price level is a consequence of oil-intensive production. In addition, some ASEAN countries highly depend on oil imports (Basnet & Upadhyaya 2015). Therefore, consumption price is volatility to the world real oil price. The foreign demand and world real oil price are the most dominant external source for the changes in within-country income gap compared to the remaining shocks. It is responsible for about 40-50% of the fluctuation of the within-country income gap volatility under a fixed exchange rate regime and about 5-17% of within-country fluctuation under a flexible exchange rate regime.

Table 6.5 presents a summary of the contribution to fluctuations of each variable for each shock for each type of exchange rate regime.

Table 6.5: Summary of the shock that makes the greatest contribution to each variable under fixed and flexible exchange rate regimes

	Fixed			Flexible		
	Short-run	***Medium-run***	***Long-run***	***Short-run***	***Medium-run***	***Long-run***
Real GDP	Foreign demand shock	Foreign interest rate shock		Foreign real interest rate shock		
CPI	World real oil price shock			World real oil price shock		
Real exchange rate	Foreign demand shock					
Within-country income gap	World real oil price shock			Foreign demand shock	World real oil price shock	

6.4.3. Robustness test

Similar to the between-countries income gap model, changing the order of restriction in the contemporaneous matrix between the price level and real exchange rate, is also employed. The results of the robustness test is illustrated in Figure E4 in Appendix E.

The results of the robustness tests are similar to those of the original within-country income gap model, confirming the robustness for the within-country income gap model. In particular, variables respond more strongly and are persistently to external shocks under a flexible than a fixed exchange rate regime. A flexible exchange rate regime is better than a fixed exchange rate regime in reducing within country income inequality if a country is hit by a negative foreign demand shock. However, a fixed exchange rate regime is superior for the case of a positive world real oil price shock because it minimises negative impact on within country income inequality. Finally, a foreign real interest rate shock seems to have minor impact on within income inequality under either exchange rate regimes.

6.5. CONCLUDING REMARKS

This chapter has employed model of within-country income gap to investigate the effects and contribution of external shocks (including a negative foreign demand shock, a

positive world real oil price shock and a positive foreign real interest rate shock) to real output, CPI, real exchange rate, and within-country income gap under fixed and flexible exchange rate regimes. To obtain the results, it is necessary to select the optimal lag length for the within-country income gap model. Our models for foreign demand, world real oil price and foreign real interest rate shocks were estimated with 1 lag. Following that, the exogeneity of external shocks was checked by the Granger causality test. The results of this test show that foreign demand, world real oil price and the foreign real interest rate can be treated as exogenous variables.

The results of impulse responses based on estimating the SVAR model are very consistent with what the model of between-country income gap produced. It is evident that the price level and real exchange rate are more volatile to external shocks under a flexible compared to a fixed exchange rate regime. Also, the effects of external shocks on these variables are more prolonged under a flexible than under a fixed exchange rate regime. Under both exchange rate regimes, the long-run impacts of the external shocks on these variables are unremarkable.

In terms of cumulative value, the results regarding the responses of real GDP, the price level and real exchange rate regime to the external shocks in model for within-country income gap are similar to that for the model for between-countries income gap. In particular, a negative foreign demand shock, except in the short-run generates higher economic growth under a flexible exchange rate regime and not a fixed exchange rate regime. A positive foreign real interest rate shock also generates higher economic growth for ASEAN countries with a flexible regime than countries with a fixed exchange rate regime. Additionally, a negative foreign demand shock and a positive foreign real interest rate shock trigger lower inflation in a country with a flexible exchange rate regime. The accumulated effects of both types of shocks on inflation seem very small under a fixed

exchange rate regime. Moreover, in terms of accumulated value, these two types of shocks cause a small real depreciation for countries with a flexible exchange rate regime. Nonetheless, these shocks seem to have negligible impacts on real exchange rate under a fixed exchange rate regime. Referring to accumulated responses, a negative foreign demand shock equalises within-country incomes under both exchange rate regimes, with greater reduction in a flexible regime. A positive foreign real interest rate shock appears to have insignificant effects on within-countries income gap under both exchange rate regimes.

Similar to the model for between-countries income gap, the results for the within-country income gap model suggest that in terms of cumulative value, a fixed exchange rate regime is superior to a flexible one in buffering a positive world real oil price shock. In particular, the shock generates higher economic growth under a fixed exchange rate regime but lower economic growth under a flexible one. The shock results in higher inflation under a fixed and a flexible exchange rate regime. However, a country with a flexible exchange rate regime suffers from higher inflation when the world real oil price increases. For accumulated effects, countries with a flexible exchange rate regime experience real depreciation as a result of a positive world real oil price shock. Real exchange rate under a fixed exchange rate regime seems to not be affected significantly by the shock. Finally, the within-country income gap is widened by a positive world real oil price shock under a flexible than under a fixed regime.

The results of variance decomposition indicate that a foreign demand shock which is followed by a foreign real interest rate is the main economic growth driver for countries with a fixed exchange rate regime. A foreign demand is also a dominant source for the volatility of real exchange rate in countries with a fixed exchange rate regime. The fluctuations in price level of countries with a fixed exchange rate regime are mostly driven

by the world real oil price. Again, a world real oil price shock is a major factor explaining the variation of income inequality under a fixed exchange rate regime.

Compared to the remaining shocks, foreign real interest rate is more important in explaining the volatility of economic growth of countries with a flexible exchange rate regime. More volatility of the price level and real exchange rate of countries with flexible exchange rate regimes is explained by the world real oil price shock rather than the remaining types of shocks. World real oil price is also responsible for the largest medium-run and long-run variation of within-country income inequality under a flexible exchange rate regime. The short-run of within-country income inequality under a flexible exchange rate regime is mostly driven by a foreign demand shock.

To test the robustness of the model of within-country income gap, a different approach, namely changing the order of the price level and real exchange rate in the contemporaneous matrix was employed. The robustness tests elicited the same results as those reported in the original model. It can therefore be stated that the within-country income gap model is robust. In the next chapter the empirical results will be employed to discuss the implications for the policies chosen by ASEAN countries.

CHAPTER 7: POLICY IMPLICATIONS

7.1. INTRODUCTION

Chapters 5 and 6 investigated and compared the effects of external shocks (a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock) on domestic macroeconomic variables and the income gap between and within ASEAN economies.

The results from using an impulse response function showed that in general real output, the price level and real exchange rate fluctuate by more from external shocks under a flexible exchange rate regime compare to that under a fixed exchange rate regime. In terms of accumulated value, a negative foreign demand shock and a positive foreign real interest rate shock generate higher economic growth and lower inflation under a flexible exchange rate regime than under a fixed one. In addition, compared with a fixed exchange rate regime, a negative foreign demand shock can reduce by more the between-countries and within-country income gap under a flexible exchange rate regime. A positive foreign real interest rate shock seems to have very small impact on the between-countries and within-country income gap. In general, a positive world real oil price shock has negative impacts on ASEAN countries. In general, a positive world real oil price shock leads to lower economic growth for countries with flexible exchange rate. Under both exchange rate regimes, a world real oil price shock causes higher inflation and a higher between-countries and within-country income gap.

The results of variance decomposition indicated that foreign demand and foreign real interest rate shocks are major drivers of changes in economic growth while prices, between-countries and within-country income gaps are mainly driven by world real oil price shock.

As mentioned in Chapter 2 that the establishment of the AEC in 2015 is a milestone

for the regional integration. Regional integration encourages the movement of goods, services, investment, labour and capital which then promotes output and economic growth. However, external shocks may be threats to the success of the AEC in attaining targets such as high economic growth, macroeconomic stability, narrowing the between-countries and within-country income gap. Hence, this section presents exchange rate policy implications for the authorities of ASEAN countries in obtaining these targets. Instituting these policies will help them cope with external shocks and enable them to achieve macroeconomic priorities. This will contribute to the success of the AEC.

This chapter is structured as follows. Section 7.2 presents policy implication for choosing the exchange rate regime for the success of the AEC. Section 7.3 discusses policy implications for dealing with external shocks. Policy implications for monetary cooperation are discussed in section 7.4. Finally, major conclusions from this chapter are presented in Section 7.5.

7.2. THE CHOICE OF EXCHANGE RATE REGIME FOR THE SUCCESS OF THE AEC

The results from the impulse response functions shown in the two previous chapters indicate that the superiority of the exchange rate regime depends on the types of shocks that occur and key policy targets. These include output stability, price stability, real exchange rate stability, narrowing income gaps between countries and within a country. These objectives are also what the AEC wants to achieve. Therefore, the choice of exchange rate regime to make this happen is key to the success of the AEC. This section will suggest the choice of exchange rate regime depending on how the authorities prioritise these targets.

Output stability: the empirical results for real GDP for both the between-countries income gap model and the within-country income gap model show that output volatility to

external shocks (a negative foreign demand, a positive world real oil price and a positive foreign real interest rate) is larger under a flexible exchange rate regime than under a fixed exchange rate regime. Therefore, a fixed exchange rate regime should be applied if an ASEAN country pursues the target of output stability. The application of a fixed exchange rate regime to stabilise output; however, also may vary depending on the stage of development. A good example of this concerns those ASEAN countries in the early economic phase of development such as the CLMV countries, may prefer their currencies to be undervalued rather than overvalued. Although undervaluation results in costlier imported goods and services in terms of domestic currency, it increases international trade competitiveness, exports and foreign investment. At this stage of development, people tend to save more than spend and, therefore, they have less demand for imported goods and services. Therefore, an undervaluation can play a role in stabilising output via exports. Regarding ASEAN countries at a higher stage of development with high imported-input such as Singapore, this country may not undervalue its currency to improve the trade balance. Hence, this country tends to overvalue its currency but it does not seriously undermine the competitiveness of exports because a lower price of imported-input decreases the costs of export production (Abeysinghe & Yeok 1998). However, the overvaluation plays a role in maintaining low inflation which promotes saving, investment and then output stability. Therefore, output stability can be attained by overvaluation in Singapore.

The effectiveness of a fixed exchange rate regime in ensuring greater output stability depends on the degree of financial market development. Levine (1999) pointed out that a well-developed financial sector assists the risk management and supplies information about risks which helps allocate capital more effectively. This contributes to reducing growth volatility. Denizer *et al.* (2002) concluded that countries with a higher level of financial market development experience smaller output volatility from shocks. Kunieda (2008)

argued that at first, more developed financial markets reduce output volatility. Nonetheless, further development of financial markets can magnify the impacts of shocks on the economy because businesses increase their financial leverage which creates higher risks and volatility. Based upon these studies, it can be concluded that the effectiveness of a fixed exchange rate regime on reducing the output volatility depends on the level of development of the financial markets of ASEAN countries.

Additionally, the effectiveness of a fixed exchange rate regime in creating less output stability depends on the importance of the trade channel (Iacoviello & Navarro 2018). A good example is that a country with higher trade dependency is more affected by a positive foreign real interest rate shock. This is because a higher foreign real interest rate reduces the demand for imported goods by foreigners. As a result, with higher trade dependency, lower foreign demand decreases domestic real output by more. Therefore, assuming a fixed exchange rate regime, a country with lower trade dependency may stabilise real output more quickly than one with higher trade dependency.

Price stability: Findings on the behaviour of the price level to external shocks indicate that the price level fluctuates more under a flexible exchange rate regime. This finding is consistent with Ghosh *et al.* (1997) and Das (2003). As mentioned earlier, the greater volatility of the price level under a flexible exchange rate regime is due to the immediate response of the nominal exchange rate to shocks which leads to faster changes in the imported price and then the domestic price level. However, under a fixed, the money supply and then the price level is passive and subject to a time-lagged (Terra 2015). Hence, a fixed exchange rate regime is preferred if stability of the price level is a priority.

However, the stability of the price level depends on characteristics of each country. For example, the more dependent one country is on imported oil the greater the impact on the price level and hence, countries with higher degree of imported oil dependency may

need more time to stabilise the price level compared to country with less oil dependency.

Real exchange rate stability: Guzman *et al.* (2018) pointed out that real exchange rate instability will drive uncertainty for the production of tradable goods and services. This reduces investment in these sectors. As indicated in the previous chapter, the real exchange rate is more stable under a fixed exchange rate regime. This is because in the short-run the nominal exchange rate responds faster than the price level and this leads to a larger adjustment of the real exchange rate under a flexible compared to a fixed exchange rate regime. Therefore, a fixed exchange rate regime is the better choice for an ASEAN country if its target is to achieve stability of the real exchange rate. With a fixed exchange rate regime, governments can stabilise the nominal exchange rate which then contributes to stabilising the real exchange rate.

However, the role of a fixed exchange rate regime in stabilising the real exchange rate depends on the characteristics of each of the ASEAN countries. Calderón and Kubota (2018) pointed out that trade openness can minimise or amplify the effects of nominal or real shocks on the real exchange rate. Therefore, assuming the presence of real shocks and a fixed exchange rate regime, countries with a lower trade openness can stabilise the real exchange rate more quickly than countries with more trade openness.

Moreover, the superiority of a fixed exchange rate regime in stabilising of real exchange rate depends on the resource deposits and dependence on oil imports. Heavy dependence on oil imports would result in trade deficits and downward pressure on the currency and a loss of international reserves to maintain the exchange rate. Therefore, it is costlier to stabilise the real exchange rate in countries with higher degree of imported oil dependency than countries with lower degree of imported oil dependency.

In addition, Calderón and Kubota indicated that financial openness can exacerbate or mitigate the impact of nominal or real shocks on the real exchange rate. Hence, with the

presence of real shock and a fixed exchange rate regime, the real exchange rate stability in countries with higher financial openness may need less time to stable real exchange rate than in countries with lower financial openness.

Narrowing the between-countries income gap: The accumulated impulse response of between-countries income gap shows that a foreign real interest rate shock seems to have small impacts on the between-countries income gap under both exchange rate regimes. This indicates that most ASEAN countries are not well integrated into global financial markets. Hence, the choice of exchange rate regime seems not affect remarkably between-countries income gap of ASEAN countries for the case of a foreign real interest rate shock.

The between-countries income gap in this study is calculated as the difference between the income of one country to the average income of all ten ASEAN countries. A decline in this income gap means more income convergence and hence, the income gap between richer and poorer countries has reduced. A good example is that if the income gap in Singapore reduces then Singapore's income is demonstrating more convergent to the average income line. This leads to a reduction in the income gap between Singapore and lower income countries. In addition, a decrease in the income gap of Myanmar means its income is more convergent to the average income line. This reduces the income gap between Myanmar and higher income countries.

The results of accumulated responses in both models for the between-countries income gap and within-country income gap show that a flexible exchange rate regime is superior to a fixed exchange rate regime in reducing the between-countries income gap if a country is hit by a negative foreign demand shock. The effect of a negative foreign demand shock on between-countries income gap of each country may vary according the degree of trade openness and trade dependence. For instance, countries with more trade openness

would be most impacted by a decline in foreign demand on income than countries with less trade openness. Therefore, the income gap may reduce by more for countries with lower trade openness. In addition, the stage of development may affect the income gap. For low income economies, they would require a depreciation of the currency to remain competitive and at least avoid a widening of the income gap. If the most trade dependent countries were high income countries a depreciation of the currency with a flexible exchange rate would reduce the income gap even more. To conclude, with the presence of a foreign demand shock, compared to a fixed exchange rate regime, a flexible exchange rate regime can help ASEAN countries reduce more between-countries income gap; however, the degree of reduction depends on characteristics of each country.

The results on the accumulated responses of between-countries income gap to world real oil price shock indicates that the shock widens the gap under both exchange rate regimes. However, the shock causes by less the between-countries income gap under a fixed exchange rate regime compared to a flexible exchange rate. Hence, a fixed exchange rate regime seems better to minimise the negative impact of a positive world real oil price shock on between-country income gap. Nonetheless, the degree of the effectiveness of a fixed exchange rate regime in minimising the negative impact of the shock on between-countries income gap depends on circumstances of each ASEAN country. As indicated earlier, heavy dependence on oil imports would result in trade deficits and downward pressure on the currency and a loss of foreign reserves to maintain the exchange rate. The money supply would decline, interest rates would rise putting further downward pressure on income. Therefore, assuming that a fixed exchange rate regime has been applied, between-countries income gap in countries with higher dependence on oil imports is more affected by the shock compared to that in countries with lower dependence on oil imports.

Narrowing within-country income inequality: Based on the results in the empirical chapters, we suggest that a flexible exchange rate regime rather than a fixed exchange rate regime should be chosen to narrow within-country income inequality when a negative foreign demand shock eventuates. Nominal devaluation as a result of a negative foreign demand shock does not play a role in stablising external demand because ASEAN countries price their export goods in foreign currency. This reduces workers' incomes in the tradable sector. The incomes of people working in the non-tradable sector increase because the expediture-switching effect of a depreciation generates substitution from imported goods to non-traded goods. This reduces the income gap between workers in the tradable and non-tradable sectors. Under a fixed exchange rate regime, only the incomes of workers in the tradable sector fall and therefore, the income gap reduces by less compared to that under a flexible exchange rate regime. However, how the within-country income gap decreases depends on the degree of trade openness and trade dependency. A country with a flexible exchange rate regime, a high degree of trade openness and trade dependency are more affected by a negative foreign demand shock. As a result, the income of workers in the export sector declines more strongly while the income of workers in the non-tradable goods sector increases more sharply. Therefore, the within-country income gap is reduced by much more in these countries compared with countries having a lower degree of trade openness and trade dependency.

The empirical results show that a positive world real oil price shock leads to higher within-countries income gap under both exchange rate regimes. However, this finding can only be applied to oil-importing countries because in oil-exporting countries, a positive world real oil price shock creates more revenues for governments which they can then use for welfare expenditure to assist the poor. Therefore, within-country income gap may be lower in oil-exporting countries.

The empirical results indicates that within-country income gap is higher under a flexible than under a fixed exchange rate regime. This can be explaine as follow. In regards to oil-importing countries, under both exchange rate regimes, higher price level, which is a result of a positive world real oil price shock, may lead to real output contraction and then unemployment. Essama-Nssah *et al.* (2007) pointed out that high-skilled workers are less affected by unemployment compared with low and medium-skilled workers. Therefore, the shock widens the within-country income gap in oil-importing countries. However, the within-country income gap will be greater under a flexible than under a fixed exchange rate regime because the price level increases more strongly under a flexible than under a fixed exchange rate regime. This is because the price level under a fixed exchange rate regime is only affected by higher price of domestic goods. Nonetheless, the price level under a flexible exchange rate regime results from both higher price of imported goods and higher price of domestic goods. As a result, higher price level under a flexible exchange rate regime leads to greater real output contraction and unemployment. This leads to greater income inequality between higher skilled and lower skilled workers under a flexible than under a fixed exchange rate regime. Therefore, a fixed exchange rate regime is a suggestion for oil-importing countries if the priority is limiting the negative effect of a positive world real oil price shock on within-country income gap.

7.3. POLICY IMPLICATION IN DEALING WITH EXTERNAL SHOCK

The results indicate that the effects of a shock depend on the types of external shocks and the exchange rate regime in operation. Therefore, this section presents policy implications for ASEAN countries in coping with external shocks according to exchange rate regime that they are applying.

A negative foreign demand shock: The results indicate that although a negative foreign demand shock results in a short-run real depreciation, domestic currency is real

appreciation in the longer time horizon under a flexible exchange rate regime. This is because the price level is sticky in the short-run and hence, a nominal depreciation, as a result of a negative foreign demand shock, leads to a real depreciation. However, in the longer term, what happens to the real exchange rate regime depends on how the nominal exchange rate changes relative to prices. A real appreciation will affect competitiveness, which then dampens the demand for ASEAN goods and trade of the ASEAN economies as well as making the impact of the decline in foreign demand worse. Therefore, ASEAN countries with flexible exchange rate regimes can conduct policies to deal with the effects of the shock on the real exchange rate. For example, they can purchase foreign securities to decrease the nominal value of the domestic currency which contributes to a lower real exchange rate.

Another policy to lower the real exchange rate is by easing monetary policy such as by increasing the money supply or reducing the interest rate if a country experiences low inflation. The expansionary monetary policy results in a fall in the nominal interest rate. This leads to a reduction in foreigners' demand for the domestic currency of a given ASEAN country. In turn, this leads to a higher real exchange rate. In short, a flexible inflation-targeting monetary policy can be combined with a flexible exchange rate regime to ensure the exchange rate remains stable in the presence of external shocks. However, these policies' effectiveness depends on the degree of trade openness and trade dependence. Countries with a higher degree of trade openness and trade dependence may be more affected by a negative foreign demand shock and therefore, these policies may be less powerful. This requires that these policies be implemented more frequently.

The empirical results show that a negative foreign demand shock leads to a contemporaneous decline in economic growth under both exchange rate regimes. Under a fixed exchange rate regime, monetary policy is ineffective while fiscal policy is effective.

Hence, to stabilise real output, ASEAN countries with a fixed exchange rate regime should conduct an expansionary fiscal policy. This increases output and then money demand. However, this may lead to an increase in the domestic interest and a nominal exchange rate appreciation. Therefore, ASEAN countries should buy foreign assets to offset these effects. Under a flexible exchange rate regime, an expansionary monetary policy should be conducted to encourage investment and consumption which then stimulates economic growth. The degree of the expansion of fiscal policy and monetary policy depends on the level of trade dependence and trade openness. A country exhibiting more trade dependence and a high degree of trade openness may be more affected by a negative foreign demand shock. Therefore, the expansion of fiscal policy or monetary policy may need to be greater and more long-lasting.

A positive world real oil price shock: The results from the accumulated impulse response functions and variance decompositions indicate that in general, under both exchange rate regimes, a world real oil price shock is an important source of fluctuation of the price level, between-countries and within-country income gap. It also causes negative effects on the economy such as output contraction, higher inflation and greater income inequality (both between-countries and within-country). To deal with the world real oil price shock, the appropriate policy should be applied according to the characteristics of each of the ASEAN country such as whether it is an oil-importing or an oil-exporting country, and whether the exchange rate regime applied is fixed or flexible. For an oil-exporting country a positive world real oil price shock generates an exchange rate appreciation which then reduces the price of imports. Changes in the overall price level depend on the decrease in the price of imports and increases in the price of domestically produced goods and services. In addition, a higher oil price increases tax revenue which then promotes government spending and real GDP. Nonetheless, an oil-importing country is faced with inflation and an output contraction as a result of a positive world real oil price

shock. This is equivalent to stagflation as a consequence of this supply shock.

Under a fixed exchange rate regime: An oil importer with a fixed exchange rate regime should ensure enough foreign reserves to maintain a fixed rate to cope with the increase in the oil price. Otherwise, it should devalue its currency. In addition, this country should conduct tight fiscal policy to control the inflation rate.

Furthermore, the results show that a positive world real oil price shock causes a higher between-countries income gap for countries with a fixed exchange rate regime. This may be because higher oil price creates income gap between oil-exporting countries (which have revenues from higher oil price) and oil-importing countries (which have to pay more because of higher oil price). In our model, we did not distinguish between oil-importing and oil-exporting countries. Hence, in reality, this result is only valid in two cases: first, oil-exporting and high income countries (because the shock makes them become richer); and second, oil-importing and low income countries (because the shock makes them become poorer). If reducing between-countries income gap is a priority, these countries, especially oil-importing and low income ones, should apply fiscal expansion policy to increase aggregate demand. This contributes to higher economic growth and then reducing the income gap between-countries.

Nonetheless, oil-exporting and low income countries become richer and hence, the between-countries income gap falls. Similarly, oil-importing and high income countries experience a lower between-countries income gap because a higher oil price makes them poorer.

As indicated in chapter 6 that inflation, which is a result of a positive world real oil price shock, may lead to the higher within-country income gap for countries with a fixed exchange rate regime. Therefore, fiscal policy expansion, in particular, subsidise on oil products should be conducted to keep price lower, which then play a role in reducing the

within-country income gap.

Under a flexible exchange rate regime: the results show that a positive world real oil price shock results in higher inflation for ASEAN countries. Regarding oil-importing countries, if inflation stability is a priority then a contractionary monetary policy (with higher short-term interest rate or slower growth rate of money supply) should be applied. Economic growth and then inflation will fall. In terms of oil-exporting countries, monetary policy contraction is needed. The degree of contraction depends on the impact of higher oil price on household, export demand and flows of investment.

Additionally, a positive world real oil price shock results in an immediate real output contraction. Therefore, an oil-importing country can conduct an expansionary monetary policy by maintaining a low short-term interest rate or increasing the money supply. This increased the aggregate demand which then promotes short-term real output.

The results also show that a positive world real oil price shock increases the within-country income gap in countries with a flexible exchange rate regime. Following Shi *et al.* (2015), because of the full exchange rate pass through to consumer price, the depreciation as a result of a positive world real oil price shock leads to even higher inflation. This leads to a decrease in aggregated demand and then non-traded goods demand. This causes unemployment and reduces the incomes of people working in the non-traded sector However, Shi *et al.* (2015) showed that an expenditure-switching effect of the deprecation leads to substitution between imported-goods and non-traded goods. This substitution effect increases the demand for non-traded goods which then creates more jobs and incomes for workers in the non-traded sector. In total, the income effect may dominate the substitution effect, resulting in lower incomes in the non-traded sector. In terms of employees in the traded sector, Shi *et al.* (2015) showed that the export price of ASEAN countries is fixed in terms of foreign currency and hence, the deprecation which results

from a positive world real oil price shock does not change the price and volume of export goods.

Therefore, the incomes of workers in the traded sector do not change. As a result, a positive world real oil price shock widens the within-country income gap of oil importing countries. Consequently, if an oil-importing country with a flexible exchange rate regime wishes to reduce its with-country income inequality then and expansionary monetary policy should be applied because a lower interest rate promotes investment and creates more jobs. In addition, the expediture-switching effect of a depreciation which is as a result of an expansionary monetary policy moves consumption from imported goods to non-traded goods. As a result, people working in the non-trable sector have more jobs and better incomes. This reduces the income gap between the tradable and non-tradable sectors.

A positive world real oil price shock also results in a higher between-countries income gap under a flexible exchange rate regime. This may be because oil-exporting countries obtain more revenues from a higher oil price while the cost of importing oil has increased in oil-importing countries. If oil-importing countries wish to narrow the between-countries income gap then monetary policy expansion should be applied. By increasing the money supply or reducing the interest rate, an expansionary monetary policy can stimulate aggregate demand which plays a role in boosting economic growth. This helps these countries reduce the income gap with oil exporting countries.

A foreign real interest rate shock: The results of variance decomposition show that a foreign real interest rate shock is the second most important source in driving fluctuations of economic growth. As previously indicated, higher foreign interest rate decreases income and demand on ASEAN goods of foreigners. Hence, given that approximately 75% of ASEAN's trade is with extra-ASEAN countries and export-led growth policy, a positive foreign real interest rate shock becomes an important source driving the economic growth

of ASEAN countries.

In addition, FDI inflows depend on the difference between the rate of return from FDI and the foreign real interest rate. Hence, the foreign real interest rate is a determinant of FDI inflows. Due to FDI-led growth strategy of ASEAN countries, growth will be driven by FDI. Therefore, the foreign real interest rate plays an important role in driving the economic growth of ASEAN countries. This shock makes a more significant contribution to fluctuations of macroeconomic variables such as economic growth and the real exchange rate under a fixed exchange rate regime compared to that under a flexible one. As mentioned earlier, this is because compared to a flexible exchange rate regime, a fixed exchange rate regime brings more certainty for investors and, hence attracts more FDI inflows.

Empirical results indicate that a foreign real interest rate shock leads to higher inflation in the short-run for country with a fixed exchange rate regime. Therefore, a country with a fixed exchange rate regime should pay more attention to coping with unanticipated foreign real interest rate shocks. Keeping low inflation leads to increased purchasing power, which increases the demand for goods and services. This results in a higher GDP level and economic growth and thereby contributes to reducing the income gap with other ASEAN countries.

Other recommendations: Exchange rate risks such as a depreciation negatively affects foreign currency denominated debt, inflation and economic growth, which then contributes to increasing the between-countries and within-country income gaps. OECD (2018) has indicated that the CLMV countries have limited access to sources of local currency denominated debt. In addition, inadequate and costly exchange rate risk hedging instruments limit their access to the international capital market. Therefore, these countries should further develop exchange rate risk hedging instruments, which will contribute to

curtailing losses when taking part in the international capital market. This contributes to reduce the income gap between them and the higher income countries.

Features of external shocks, for example temporary or permanent, should be taken into account because responses of the economy to each distinguished feature may vary, therefore, policies will differ. Downes (2007) showed that if households believe that a positive oil price shock is temporary then they will respond less to their lower real income and still retain their consumption via savings. Therefore, the responses of polices to deal with the shock may be smaller. However, a shock may have medium-run and long-run effects. Medium-run and long-run outcomes may last far beyond the effectiveness of short-run policies. Therefore, the authorities should identify which types of external shocks have short-run and long-run effects. Identifying external shocks that have short-run effects helps the authorities devise suitable policies to implement suitable policies to deal with contemporaneous effects. In addition, identifying external shocks leading to long-run effects helps the authorities develop and implement appropriate policies for sustained economic growth.

Moreover, ASEAN countries' governments should monitor changes in the policies and the economy of major trading partners to predict changes in their demand on goods and services so they can implement prompt policies to deal with foreign demand shocks.

7.4. RECOMMENDATIONS FOR MONETARY, FINANCIAL AND EXCHANGE RATE COOPERATION

The empirical results for the model representing the between-countries income gap show that variables (output, price level, real exchange rate, income inequality) respond differently under different exchange rate regimes. This means that the responses of macroeconomic variables to the same shock vary within ASEAN because they have quite different exchange rate regimes as well as different economic structures, resources as well as being at different stages of development. Therefore, policies that each ASEAN country

applies to cope with shocks may be different. In addition, some ASEAN countries have a higher inflation rate than others and this difference leads to unbalanced or inconsistent purchasing power and investment. This affects economic growth and per capita income which then widens the income gap between the countries. In addition, ASEAN countries mostly trade with countries outside the region and hence, monetary and fiscal policy between ASEAN members seems to have little spill-over impacts. As a result, each country can independently operate its own monetary and fiscal policy (Downes 2007). This is an obstacle for policy coordination (such as exchange rate coordination) between the ASEAN countries. Capannelli and Menon (2010) pointed out that based on the European experience, the exchange rate regime chosen by members is not essential to establish a monetary union as long as their exchange rate regimes allow them to satisfy convergence criteria. They also showed there is no requirement of a common exchange rate regime for the period of transition. Therefore, Capannelli and Menon (2010) suggest that each ASEAN country apply its own exchange rate regime, yet have the same standard of inflation targeting where fluctuation bands and indicators should not differ. This helps ASEAN countries to simultaneously achieve targets such as reducing inflation and exchange rate stability.

Yong (2004) indicates that the intensity of intra-regional trade and convergence in macroeconomic conditions (such as level of economic development and the readiness for economic integration) are two of the most crucial criteria for the suitability of a common currency. Since most ASEAN trade is with non ASEAN members, the major concern is with maintaining exchange rate stability with currencies of major trading partners and in particular the US dollar rather than exchange rate stability between themselves. Therefore, to promote intra-ASEAN trade, the exchange rates of the ASEAN countries should be better coordinated. In particular, each country should retain intra-regional exchange rate stability. This promotes intra-ASEAN trade and FDI flows from the higher income

countries to the lower income ones, thereby stimulating economic growth and reducing the between-countries income gap. As suggested by Ho and Yuen (2011), to maintain the stability of the intra-ASEAN exchange rates, the countries should adopt the same basket of currencies to peg their currencies to such as the USD, EUR or JPY. This helps ASEAN countries limit exchange rate risks and keeps the intra-ASEAN exchange rate stable. This then plays a role in reducing the transaction costs within ASEAN and promoting intra-ASEAN trade, FDI and economic growth. As a result, this may generate a narrowing of the between-countries income gap which then creates greater convergence in macroeconomic conditions and the feasibility of a common currency in the future. In addition, reducing between-countries income gap promotes long-run coordination between ASEAN countries (Park 2000).

At present, ASEAN countries do not meet the precondition for forming an OCA due to income disparity problems, economic divergence and the asymmetry of external shocks. The empirical results suggest that the responses of macroeconomic variables and the between-countries income gap to external shocks vary according to different exchange rate regimes. Therefore, policies aimed at dealing with external shocks that ASEAN countries should apply are different. In addition, applying a similar exchange rate regime for the ASEAN countries seems impossible at this juncture because each country has their own priorities. The key issue is the acceptance of common goals and priorities (for example, all countries accept that closing the income gap between them is the top priority) and taking actions in terms of monetary, fiscal and exchange rate policy to achieve this. If certain ASEAN countries have to accept greater domestic output, price and real exchange rate volatility then a critical issue is whether they will accept this just to enable other member countries to close the income gap. Therefore, as suggested by Rillo (2018), greater macroeconomic and policy coordination is desired to attain a common development goal. This coordination would include regional surveillance, peer review, policy discussions, and

market consultations. The author also suggested that trade and financial policies should be coordinated to facilitate deeper integration in trade and investment. A positive foreign real interest rate shock can lead to capital withdrawals of investors which then may result in financial instability. Hence, financial supports through Chiang Mai Initiative and its Multilateralization (CMIM) are needed to reduce the negative impact of the shock. Especially, the supports should be prioirtised on small and lower income countries such as CLMV.

ASEAN countries should cooperate in elimiting regulatory barriers. This helps regional financial market become more integrated. An integrated regional financial market encourages the capital flows from the higher income countries to the lower income countries, which then promotes economic growth of the lower income countries and speed up the process of catching up in GDP per capita. This contributes to reduce between-countries income gap in ASEAN.

7.5. CONCLUDING REMARKS

This chapter has discussed issues for ASEAN countries in relation to choosing which exchange rate regime suits them best. The optimal exchange rate regime depends on the priorities that a country pursues. A fixed exchange rate regime based on the evidence presented in the previous chapter, will attain stable output, real exchange rate and price level stability. In terms of reducing the negative impact of shocks on between-countries and within-country income inequality, a flexible exchange rate regime is the better option if the shock emanates from foreign demand while a fixed exchange rate regime should be chosen if a world real oil price shock occurs. However, the effectiveness of these exchange rate regimes in stabilising output, real exchange rate, price level and narrowing between-countries and within-country income gap depends on the characteristics of each ASEAN country such as degree of trade dependency, trade openness, financial development,

whether they are oil importers or oil exporters and stage of development.

This chapter also suggested appropriate monetary or fiscal policy to deal with a foreign demand shock, world real oil price shock and foreign real external shocks according to each type of exchange rate regime that an ASEAN country has applied. In particular, to improve the competitiveness of ASEAN countries, those with a flexible exchange rate regime should conduct an expansionary monetary policy or purchase foreign securities. Additionally, an expansionary fiscal policy for countries with fixed exchange rate regimes while an expansionary monetary policy for countries with a flexible one, should be applied to ameliorate the damage done by a negative foreign demand shock on economic growth.

In terms of a positive world real oil price shock, this study suggests that a fiscal policy contraction for oil-importing countries with fixed exchange rate regimes and a monetary policy contraction for oil-importing countries with a flexible exchange rate regime should be employed to restrain the inflation. However, if a narrowing of the between-countries income gap is a priority then a fiscal policy expansion should be applied for oil-importing countries with fixed exchange rate regime whereas an expansionary monetary policy is a recommendation for oil-importing countries with a flexible exchange rate regime.

A positive foreign real interest rate shock causes higher inflation for countries with a fixed exchange rate regime. This type of shock also plays an important role in the economic growth of countries with a fixed exchange rate regime. Therefore, these countries should pay more attention to this type of shock and conducting tight fiscal policy to curb inflation.

This chapter also suggests that ASEAN authorities should identify the characteristics of external shocks such as whether they are permanent or temporary and their effects on

variables (short-run or long-run), so they can implement appropriate policy responses. In addition, changes in policies and the economy of trading partners should be monitored to implement timely policies with the objective of limiting the negative effects of external shocks. Moreover, a world real oil price shock especially should be taken into account in establishing macroeconomic policies. This is because an oil price shock is the main source driving the fluctuations in the price level, the real exchange rate, between-countries income gap and within-country income gap.

This chapter has also recommended some cooperation policies; in particular, while each ASEAN member country can pursue its own exchange rate regime, they should apply the same inflation targeting standard. This helps to promote intra-ASEAN trade. Doing so will encourage investment from higher income countries to lower income ones. Thus ASEAN can enjoy higher economic growth and reduce the income gap between member countries which is one of the main targets of the AEC. Finally, further macroeconomic and policy cooperation such as regional surveillance, policy discussion and market consultation should be conducted to obtain common development of mutual benefit.

CHAPTER 8: CONCLUSION

8.1. INTRODUCTION

Aiming to transform ASEAN into "a stable, prosperous, and highly competitive region with equitable economic development, and reduced poverty and socio-economic disparity", the AEC was established in 2015. The next phrase of economic integration is to achieve AEC in 2025, which was outlined in the AEC Blueprint 2025, with characteristics such as sustained high economic growth, resilience to the external shocks, more equitable and inclusive economic growth that narrow the income gap between and within ASEAN countries, highly regional integration, more integrated with the world economy. However, more integration to the global economy means that ASEAN will be more greatly affected by the external shocks which may in turn impact negatively on macroeconomic stability, economic growth and inflation. In the literature, exchange rate regime plays a role in transmitting the effects of external shocks on real output, real exchange rate and the price level.

The literature shows the links between economic growth and between-countries income gap. It also indicates the relationship between real exchange rate, inflation, economic growth and within-country income gap. However, no study has yet investigated the role of exchange rate regime in transmitting the impacts of external shocks on between-countries and within-country income gap. Hence, this thesis investigates the effects and contributions of external shocks to between-countries and within-country income gap under a fixed and a flexible exchange rate regime. It also looks at the effects and the contribution of external shocks to real output, the price level and real exchange rate for 10 ASEAN countries under a fixed and a flexible exchange rate regime. This helps us better understand the external shocks mechanism transmission to real output, the price level, real exchange rate, between-countries and within-country income gap via the exchange rate

regime channel. This study suggests policy implications for ASEAN authorities for the attainment of the AEC.

This study aims to answer the following questions: 1. What are differences in responses of real output, the price level and real exchange rate to external shocks (including a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock) between a fixed and a flexible exchange rate regime? 2. What impacts do external shocks make on the between-countries income gap and within-country income gap under a fixed and a flexible exchange rate regime? 3. What are the similarities and differences between the effects of external shocks under a fixed and a flexible exchange rate regime? 4. Which exchange rate regime is superior in minimising the negative effects of external shocks? 5. Which is the dominant external source of the volatility of real output, the price level, real exchange rate, between-countries income gap and within-country income gap under a fixed and a flexible exchange rate regime?

These research questions are addressed in the next section, Section 8.2. Section 8.3 provides policy implications for ASEAN countries in coping with external shocks. It also give recommendations for the exchange rate regime best suited to ASEAN in reducing negative impacts of external shocks on real output, the price level, real exchange rate, between-countries and within-country income gap. Furthermore, it proposes recommendations on policies for regional cooperation. Section 8.4 presents some limitations of this study. Finally, based on these limitations, Section 8.5 suggests possible avenues that future research could pursue.

8.2. SUMMARY OF MAIN EMPIRICAL FINDINGS

This section presents main findings for research questions which were raised in Chapter 1. The research questions are on the following: investigating and comparing the effects of external shocks on real output, the price level, real exchange rate, between-

countries and within-country income gap between a fixed and a flexible exchange rate regime; identifying the dominant shocks driving the volatility of these variables under a fixed and a flexible exchange rate regime; and identifying the policy recommendations for ASEAN countries in reducing the negative impacts of external shocks and the attainment of the AEC. The main findings are summarised below.

1. What are differences in responses of real output, the price level and real exchange rate to external shocks (including a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock) between a fixed and a flexible exchange rate regime?

To answer this question we used impulse response functions, which were generated from the model for between-countries income gap and model for within-country income gap. The empirical results from both models are consistent. In particular, in general, real output, the price level and real exchange rate are more fluctuated to the external shocks under a flexible than under a fixed exchange rate regime.

In terms of accumulative value, a negative foreign demand shock and a positive foreign real interest rate shock generate higher economic growth and lower inflation under a flexible than under a fixed exchange rate regime. These shocks result in real depreciation under a flexible exchange rate regime whereas they seem have muted impacts on real exchange rate regime under a fixed exchange rate regime. Nevertheless, countries with a flexible exchange rate regime suffer more from lower economic growth, higher inflation than countries with a fixed exchange rate regime when they are hit by a positive world real oil price shock.

2. What impacts do external shocks make on the between-countries income gap and within-country income gap under a fixed and a flexible exchange rate regime?

The findings from impulse responses function indicate that the effects of external shocks (a negative foreign demand shock, a positive world real oil price shock and a positive foreign real interest rate shock) on between-countries and within-country income gap are larger and long-lasting under a flexible exchange rate regime. Regarding the accumulated value, in general, a negative foreign demand shock narrowed between-countries income gap more under a flexible exchange rate regime than under a fixed regime. Nevertheless, a positive world real oil price shock increases the between-countries income gap and within-country income gap in a fixed and a flexible exchange rate regime, with greater gaps in the latter regime. In terms of accumulated responses, the between-countries income gap and within-country income gap under a fixed and a flexible exchange rate regime seem to change insignificantly if a country is hit by a positive foreign real interest rate shock.

3. What are the similarities and differences between the effects of external shocks under a fixed and a flexible exchange rate regime?

The results from the impulse response function show that all types of external shocks have greater short-run impacts on variables under a flexible than under a fixed exchange rate regime. Additionally, under both exchange rate regimes, they have insignificant impacts on variables in the long-run. Furthermore, the effects of external shocks are more long-lasting under a flexible than under a fixed exchange rate regime. Nonetheless, compared to the remaining types of shocks, the effect of positive foreign real interest rate shock is more short-lived.

4. Which exchange rate regime is superior in minimising the negative effects of external shocks?

We conclude that the superiority of exchange rate regime depend on the targets. In particular, a fixed exchange rate regime is better than a flexible one in reducing the volatilities of real output, the price level and real exchange rate.

However, in terms of accumulated effects, a negative foreign demand shock and a positive foreign real interest rate shock generate an immediate and larger increase in real exchange rate regime which then promotes higher economic growth, and lower inflation under a flexible than under a fixed regime. This is because the larger immediate devaluation under the former regime results in a cushioning of real output from the full impact of a negative foreign demand shock and a positive foreign real interest rate shock. Therefore, it can be said that a flexible exchange rate regime is better in absorbing a negative foreign demand shock and a positive foreign real interest rate shock. Nonetheless, in terms of accumulated effects, with reference to countries with a flexible exchange rate regime, they suffer more from a positive world real oil price shock with lower economic growth and higher inflation. Although the world real oil price shock results in immediate and larger real depreciation, higher inflation under a flexible exchange rate regime limits any buffering of the shock of the real exchange rate regime. Therefore, the impacts of the shock fully pass through the economy with a flexible exchange rate regime. We conclude that the fixed exchange rate regime is better at coping with the world real oil price shock.

5. Which is the dominant external source of the volatility of real output, the price level, real exchange rate, between-countries income gap and within-country income gap under a fixed and a flexible exchange rate regime?

To answer this question, we employed variance decomposition to assess the contribution of each type of external shock on the short-run, medium-run and long-run volatilities of these variables under a fixed and a flexible exchange rate regime. The findings concerning both models (i.e. between-countries and within-country income gaps) show that in general, the fluctuation of economic growth of ASEAN countries under both exchange rate regimes are more driven by a foreign demand shock and a foreign real interest rate shock. The fluctuation of the price level in these countries with a fixed and a flexible exchange rate regime is mostly driven by the world real oil price shock. This type

of shock also makes the greatest contribution to the variation in the real exchange rate and between-countries income disparity under a flexible exchange rate regime. Under a fixed exchange rate regime, a world real oil price shock can explain the greatest percentage of changes of within-country income inequality. The shock also accounts for the largest proportion of long-run variation of within-country income gap under a flexible exchange rate regime.

8.3. POLICY IMPLICATIONS AND RECOMMENDATIONS

The results of empirical analysis indicate that variables have responded differently to external shocks under a fixed compared to under a flexible exchange rate regime. There are differences in the contribution of external shocks to the volatilities of variables between a fixed and a flexible exchange rate regime. This study has some policy implications and recommendations to make in choosing the exchange rate regime, dealing with external shocks and regional cooperation which contribute to attaining AEC.

First, this study recommends policies for the choice of exchange rate regime according to what the priorities are. In particular, a fixed exchange rate regime should be chosen if macroeconomic stabilities such as real output stability, price level stability and real exchange rate stability are desired. Furthermore, a flexible exchange rate regime is a good choice with the presence of a negative foreign demand shock if narrowing between-countries and within-country income gap is what is wanted. However, for a positive world real oil price shock, a fixed exchange rate regime is better than a flexible one because it can minimise the negative impact of the shock on between-countries and within-country income gap.

Second, this study has policy implications for coping with external shocks. In particular, in terms of a negative foreign demand shock, expansionary monetary policy or purchasing foreign securities should be employed for countries with flexible exchange rate

regimes to offset the real appreciation caused by the shock. This helps improve competitiveness for ASEAN countries. Due to the negative effects of a negative foreign demand shock on economic growth under both exchange rate regimes, this study suggests a fiscal policy expansion for countries with fixed exchange rate regimes while expansionary monetary policy for countries with a flexible one.

In terms of a positive world real oil price shock, this study shows that oil-importing countries are negatively affected by the shock. For example, a positive world real oil price shock leads to poorer economic growth, higher inflation and greater income gap in both between-countries and within-country contexts. Oil-importing countries with fixed exchange rate regimes should prepare enough foreign reserves to maintain the fixed rate and fiscal policy contraction to curb inflation. However, a fiscal policy expansion should be implemented if reducing between-countries income gap is a priority. Also, some policies for oil-importing countries will require a flexible exchange rate regime. A good example is where a contractionary monetary policy should be applied if these countries desire less inflation whereas monetary policy expansion is recommended to promote economic growth. In addition, an expansionary monetary policy encourages investment, aggregated demand, economic growth and employment which then play a role in reducing between-countries and within-country income gap.

Regarding a positive foreign real interest rate shock causes higher inflation for countries with a fixed exchange rate regime. This type of shock also plays an important role in economic growth of countries with fixed exchange rate regimes. Therefore, these countries should pay more attention to this type of shock such as modelling the economy and conducting a tight fiscal policy to curb inflation.

To deal with external shocks, this study suggests other recommendations. External shocks can cause exchange rate risk such as domestic currency depreciation. Hence,

CLMV countries should develop exchange rate risk hedging instruments to reduce the loss from the foreign capital market. This plays a role in reducing income gap to higher income countries. In addition, characteristics of external shocks such as temporary or permanent shocks and the effects of external shocks in the short-run and long-run should be taken into account when constructing policies. This helps policy-makers devise and implement the appropriate policies. Additionally, this study recommends that changes in policies and economic environment of trading partners should be carefully observed.

Third, this study suggests some recommendations for the monetary, financial and exchange rate cooperation. A good example is that ASEAN countries can apply their own exchange rate regime; however, the same standard of targeting inflation should be implemented. In addition, the intra-ASEAN exchange rate needs to be stabilised to promote intra-ASEAN trade and investment. Next, ASEAN currencies should be linked to a basket of currencies instead of one specific currency, in order to reduce the exchange rate risk. This reduces transaction costs and promotes intra-ASEAN trade. Additionally, greater macroeconomic and policy coordination is needed to obtain a common economic development objective. Finally, this study suggests that the cooperation in eliminating regulatory barriers should be conducted to make regional financial market become more integrated. This boosts economic growth of low income countries which then plays a role in narrowing between-countries income gap.

8.4. CONTRIBUTION AND SIGNIFICANCE OF THE RESEARCH

This research attempts to investigate what is the optimal exchange rate regime for ASEAN countries by comparing the effects external shocks on the fluctuation of macroeconomic variables, namely: real GDP, price level, real exchange rate, between-countries and within-country income inequality under fixed and flexible exchange rate regimes. In addition, it attempts to evaluate the contribution of external shocks to the

fluctuations of variables under both fixed and flexible exchange rate regimes. This research makes a significant contribution to the topic of the exchange rate regime and the attainment of economic integration as follows:

(1) This research is the first empirical investigation on the effects and contribution of external shocks on the between-countries income gap under a fixed and a flexible exchange rate regime by involving a group of countries (ASEAN) wishing to engage in closer economic integration in which sustainable and equitable economic growth is seen as a high priority. So ASEAN countries represent an excellent case study of economic integration with a priority on between-countries income inequality.

Traditional studies only focus on output, prices, trade balance, consumption and real exchange rate outcomes. Even the OCA literature has not given this issue credence but it has now become a critical aspect if closer integration is to be achieved. As mentioned in Chapter 3, other studies only looked at the effects of external shocks on economic growth under a fixed and a flexible exchange rate regime. Also, other analyses investigated the link between economic growth and income gap between countries. Hence, this study extends the literature by combining these two strands of research to investigate the effects and contributions of external shocks on between-countries income gap. As well, this study extends the literature on the choice of exchange rate regime by investigating the role of exchange rate regime in transmitting the effects of external shocks on between-countries income gap.

(2) Similarly, Chapter 3 indicated that within-country income gap is affected by the external shocks, output, price level and real exchange rate. Moreover, the literature on the choice of exchange rate regime showed the role of exchange rate regime in transmitting the effects of external shocks on output, the price level and real exchange rate. Hence, this is the first empirical study bridging these two strands of research that investigates the

exchange rate regime channels, specifically in the context of transmitting the effects and contributions of external shocks to within-countries income gap.

(3) To the best of our knowledge, there has been scant empirical study done on various types of external shocks in investigating the superiority of fixed or flexible exchange rate regime. This is the first study to investigate similarities and differences between the impacts and contributions of a financial shock (foreign real interest rate shock), a goods market demand shock (foreign demand shock) and a goods market supply shock (world real oil price shock) on macroeconomic variables, between-countries and within-country income gap under a fixed or flexible exchange rate regime. We found that the long-run effects of all three types of shocks on variables are relatively small. All of the shocks have larger short-run effects under a flexible rather than under a fixed exchange rate regime. A negative foreign demand shock and a positive world real oil price shock have more long-lasting effects than a positive foreign real interest rate shock.

(4) Specifically, we expand the empirical literature on the choice of exchange rate regimes by focusing on countries which are part of an economic zone. Unlike Chia *et al.* (2012) who included all ten ASEAN countries in a sample of 33 small open Asian countries, this study seeks to minimise the heterogeneity of the sample by focusing only on these ten nations that share common economic features and trading policies and aims as given by the AEC. So this study considers some OCA issues but goes beyond this to look at the issue of income equality and sustainable development.

(5). The next contribution of this study is to apply the IMF's new *de facto* classification, which has not been previously employed in investing in the exchange rate regimen which is superior, and in so doing this study provides additional empirical evidence on the merits of different exchange rate regimes. In particular, Hoffmann (2007) and Zhang *et al.* (2014), who employed exchange rate classification of Reinhart and Rogoff (2004) and Ilzetzki *et al*. (2008), respectively, found that a flexible exchange rate

regime can absorb a positive foreign real interest rate shock. By using the IMF's *de facto* exchange rate regime classification, we provide evidence to support this assertion. In addition, Broda (2004), Hoffmann (2007), Chia *et al.* (2012) and Zhang *et al.* (2014) found that the contemporaneous effects of external shocks on real output is larger under a fixed exchange rate regime than under a fixed one. Nonetheless, our findings are consistent with Al-Abri (2013), Cook (2004) and Towbin and Weber (2013) who found that real output is more stable under a fixed exchange rate regime. Hence, using the IMF's *de facto* exchange rate regime classification, this study provides more evidence to support Al-Abri (2013), Cook (2004) and Towbin and Weber (2013).

(6) The empirical results have exchange rate policy implications for ASEAN countries in the context of regional integration. This study suggests choosing an exchange rate regime according to the priorities of each country. In addition, this study suggests monetary policy, fiscal policy and other recommendations to deal with each type of external shock according to exchange rate regime being implemented. Finally, this study gives recommendations on how to achieve monetary and exchange rate cooperation.

8.5. LIMITATIONS AND SUGGESTIONS FOR FURTHER STUDIES

(1) Due to the unavailability the data, this study has only focused on ASEAN countries as a bloc. However, future studies should divide ASEAN into two groups: the higher-income countries, including Brunei, Malaysia, the Philippines, Indonesia, Singapore and Thailand; and lower income countries, these being Cambodia, Laos, Myanmar and Vietnam. Doing so will make it easier to better understand the behaviour of the between-countries and within-countries income gap in each group in reaction to shocks under fixed and flexible exchange rate regimes.

(2) Chapter 3 indicates that the within-country income gap plays a role in economic growth which affects the between-countries income gap. Hence, there is a possible link

between the between-countries and within-country income gap. Nonetheless, no existing theories have considered this relationship. Hence, this relationship should be considered in future research. Especially, this relationship should be thoroughly investigated under different exchange rate regimes to understand better how they are connected.

(3) Although the GFC played an important role in the ASEAN economy, the sample size for this study is too small for a division into two sub-samples (before and after the GFC). Hence, to better understand whether there is a difference in responses of variables to shocks between before and after the crisis, further studies should divide the sample into two sub-samples with a longer time period.

(4) Due to the limited data, this study could not examine the responses of macroeconomic variables to shocks across exchange rate regime for each ASEAN country, to know whether the response of variables under each type of exchange rate regime is symmetric. This would help to conclude if an OCA between member countries is feasible for ASEAN.

APPENDIX A: APPENDIX TO CHAPTER 2

Table A1: Summary of the process of regional cooperation

Year	Cooperation
1961	Association of Southeast Asia
1976	ASEAN Industrial Projects
1977	ASEAN Preferential Trading Arrangement
1981	ASEAN Industrial Complementation
1983	ASEAN Industrial Joint Ventures
1988	Brand to Brand Complementation
1992	ASEAN Free Trade Area
1995	ASEAN Framework Agreement on Services
1996	ASEAN Industrial Cooperation
1998	Framework Agreement for an ASEAN Investment Area
2015	ASEAN Economic Community

Table A2: Annual inflation rate of ASEAN countries (1987-2017)

	Vietnam	Cambodia	Laos	Myanmar	Indonesia	Malaysia	Philippines	Thailand	Brunei	Singapore
1987	360.357	-31.248	6.112	n/a	9.273	0.737	3.042	2.502	1.275	0.483
1988	374.354	23	14.8	n/a	8.044	0.29	12.23	3.833	1.193	1.523
1989	95.77	63.8	59.7	n/a	6.418	2.557	11.367	5.403	1.31	2.294
1990	36.031	141.8	-26.317	n/a	7.843	3.043	13.201	5.87	2.133	3.45
1991	81.817	191	13.439	n/a	9.369	4.328	19.261	5.729	1.583	3.44
1992	37.705	75	9.847	n/a	7.506	4.778	8.651	4.09	1.259	2.244
1993	8.379	114.319	5.65	n/a	9.688	3.547	6.716	3.291	4.288	2.291
1994	9.488	10.44	7.67	n/a	8.518	3.687	10.393	5.121	2.448	3.095
1995	16.93	10.077	19.075	n/a	9.432	3.468	6.859	5.769	5.972	1.725
1996	5.59	7.147	19.147	n/a	8.379	3.479	8.312	5.82	1.965	1.379
1997	3.1	10.503	19.544	n/a	6.194	2.655	5.656	5.638	1.705	2.023
1998	8.11	12.899	90.141	49.136	58.02	5.293	9.361	7.979	-0.424	-0.271
1999	4.11	1.996	128.409	10.899	20.75	2.731	6.162	0.254	-0.008	0.024
2000	-1.77	-0.826	8.373	-1.723	3.773	1.551	6.569	1.655	1.174	1.348
2001	-0.31	-0.117	7.809	34.503	11.502	1.427	5.403	1.581	0.603	1.015
2002	4.08	-0.036	10.633	58.104	11.78	1.793	2.723	0.725	-2.288	-0.392
2003	3.3	1.027	15.489	24.948	6.773	1.074	2.269	1.812	0.3	0.487
2004	7.89	3.925	10.467	3.757	6.062	1.42	4.791	2.761	0.897	1.672
2005	8.39	6.349	7.167	10.741	10.459	3.039	6.595	4.519	1.087	0.468
2006	7.5	6.143	6.546	26.328	13.104	3.621	5.467	4.664	0.154	0.963
2007	8.35	7.668	4.662	30.935	6.662	2.027	2.942	2.203	0.966	2.105
2008	23.12	24.997	7.629	11.543	9.777	5.429	8.184	5.462	2.085	6.628
2009	6.72	-0.663	0.141	2.246	5.047	0.597	4.213	-0.848	1.043	0.597
2010	9.21	3.997	5.983	8.222	5.14	1.72	3.784	3.286	0.216	2.823
2011	18.669	5.478	7.569	2.766	5.344	3.174	4.718	3.811	0.142	5.248
2012	9.103	2.925	4.255	2.829	3.981	1.664	3.171	3.013	0.108	4.576
2013	6.595	2.955	6.371	5.716	6.413	2.105	2.933	2.185	0.382	2.359
2014	4.085	3.852	4.066	5.109	6.395	3.143	4.174	1.896	-0.199	1.025
2015	0.631	1.225	1.292	10.044	6.363	2.104	1.409	-0.9	-0.423	-0.523
2016	2.668	3.025	1.644	6.765	3.526	2.076	1.784	0.188	-0.731	-0.532
2017	3.521	2.906	0.825	5.1	3.809	3.799	3.176	0.665	-0.137	0.577

Source: World Economic Outlook, IMF

APPENDIX B: APPENDIX TO CHAPTER 3

Table B1: Summary of the theoretical literature on the roles of exchange rate regimes in transmitting the effects of shocks on macroeconomic variables

Authors	Types of shocks	Objective	Results
Meade (1951), Friedman (1953)	Real shock	Output stability	The fluctuation of output to real shocks is smoother under a flexible regime
Fleming (1962), Mundell (1963)	Real and nominal shocks	Output stability	The superior of exchange rate regime depends of degree of capital mobility and type of shock. A small open economy with a high degree of capital mobility can cope with nominal shock better if it applies a fixed regime whereas it can buffer the real shock better under a flexible regime.
Moosa (2005)	Domestic/external shocks	Output stability	A flexible exchange rate regime is better to deal with external real shocks, external nominal shocks and internal real shocks. Nonetheless, a fixed exchange rate regimes is superior if the shocks are domestic nominal shocks.
Poole (1970), Turnovsky (1976)	Domestic/external shock	Output stability	Output is more stable under a flexible regime if shocks are from foreign trade or foreign price. A fixed regime is superior if shocks are domestic monetary. The superiority of exchange rate regime in dealing with other types of shocks depends on the countries's characteristics.
Krugman and Taylor (1978)	Real exchange rate shock	Output stability	No exchange rate regime is better.
Mundell (1961) McKinnon (1963)	Real shock	Output stability	The superiority of exchange rate regime depends on the degree of oppeness. In particular, fixed exchange rate regime is better for small open economies in reducing output volatility.
Fischer (1977), Frenkel and Aizenman (1982)	Nominal and real shock	Consumption stability	Flexible/fixed exchange rate regime is better to cope with nominal/real shock.
Flood (1979), Joshua (1983), Melvin (1985)	Nominal shock	Domestic price stability	A fixed exchange rate regime is more prefererable.
Devereux and Engel	Monetary shocks	Consumer price	The merit of exchange rate regime depends on the currency that is set in the price of imported

(2003)		level	goods.
Marston (1981), Aizenman (1985)	Internal/external monetary and aggregate demand shocks	Output stability	The degree of wage indexation decides the superiority of exchange rate regime.
Pilbeam (2004)	Money demand, aggregate demand and supply shocks	Stability of output and price level	The ranking of exchange rate regime depends on the weighting that the authorities put on output and price stability, wage indexation, the type of shocks hitting the economy, structural parameters such as income elasticity of demand, the degree of openness and the elasticity of aggregate demand to fluctuations in the real exchange rate and real interest rate

Table B2: Summary of the empirical literature on the roles of exchange rate regimes in transmitting the effects of shocks to macroeconomic variables

Authors	Countries and time periods	Time period	Methodology	Types of shock	Variables	Exchange rate regime classification	Results
Bleaney and Fielding (2002)	80 developing countries	1980-1989	Probit & OLS regression	TOT	Inflation level, inflation stability, output stability	Ghosh *et al*. (1997)	Output is insensitive to the exchange rate regime
Kemme and Koleyni (2017)	Mexico	1960:Q1-2014:Q4	DSGE	US technology shock, US preference shock and US monetary shock	Price level	Not mentioned	Inflation due to shocks is higher under fixed than under flexible exchange rate regime
Hoffmann (2007)	42 developing countries	1973-1999	Exogenous VAR	World output, world real interest rate shocks	Real GDP, the real exchange rate and trade balance	*De jure* of IMF and *de facto* of Reinharh and Rogoff (2004)	The exchange rate classification has significant effects on the impacts of shocks on macroeconomics variables between the fixed and flexible exchange rate regimes.
Broda (2004)	75 developing countries	1973-1996	Structural vector autoregressive model (SVAR)	TOT shock	Real GDP, the real exchange rate and consumer price	The combination of *de jure* and *de facto* of Ghosh *et al* (1997)	The flexible exchange rate regime is better than the fixed exchange rate regime in minimising the negative effect of shocks on short-run real GDP.
Chia *et al.* (2012)	33 small Asian open economies	1980-2009	DSGE model and SVAR model	Foreign nominal interest rate shocks	Real GDP, the real exchange rate and consumer price	*De facto* exchange rate classification of Reinhart and Rogoff (2004)	The flexible exchange rate regime produces greater output stability.

Zhang *et al.* (2014)	Nine East Asian countries	1980-2010	Panel SVAR model	Foreign real interest rate	Real GDP, real exchange rate and price level.	*De facto* exchange rate regime of Ilzetzki *et al.* (2008)	The same conclusion as Chia *et al.* (2012)
Towbin and Weber (2013)	101 countries	1974-2007	Interacted Panel Vector Autoregression (IPVAR)	Real external shocks	Output stability	*De facto* exchange rate regime classification of Levy-Yeyati and Sturzenegger (2005).	The merit of flexible exchange rate regime in insulating shocks can be seen in countries with low foreign currency debt and high pass-through goods. However, countries with high foreign currency debt and low pass-through goods, both fixed and flexible exchange rate regime have the same stabilization patterns.

Shi *et al.* (2015)	East Asian		Calibration	Foreign demand shock, technology shock in export sector, foreign interest rate shock	Welfare		- The high use of foreign currency in export pricing and low elasticity of substitution between domestic and foreign traded goods prevents the adjustment of the exchange rate in response to external shocks. Hence, a flexible exchange rate regime cannot ensure the stability of the economy. - Inflation is more fluctuated under a flexible regime
Rogoff *et al.* (2004)	158 countries from 1970 to 1999				Inflation, output growth, growth volatility and the incidence of crises.	*De jure* and natural classification	The degree of access into global financial market affects the merit of exchange rate regime.
Aghion *et al.* (2009)	83 countries from 1960 to 2000,						The superiority of exchange rate regime depends on the degree of financial development

APPENDIX C: APPENDIX FOR CHAPTER 4

TABLE C1: EXCHANGE RATE REGIMES OF ASEAN COUNTRIES 1999-2014

Year	Brunei	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
1999	Currency board	Managed floating with no pre-determined path for the exchange rate	Independently floating	Managed floating with no pre-announced path for the exchange rate	Conventional pegged arrangement	Conventional pegged arrangement	Independently floating	Managed floating with no pre-announced path for the exchange rate	Independently floating	Pegged exchange rate within horizontal
2000										
2001			Managed floating with no pre-announced path for the exchange rate			Managed floating with no pre-announced path for the exchange rate			Managed floating with no pre-announced path for the exchange rate	Managed floating with no pre-announced path for the exchange rate
2002										
2003										
2004										
2005					Managed floating with no pre-announced path for the exchange rate					
2006										
2007										Conventional pegged arrangement
2008		Floating	Floating	Other managed arrangement	Floating	Other managed arrangement	Floating	Floating	Floating	Other managed arrangement
2009		Stabilized arrangement		Stabilized arrangement				Other managed arrangement		
2010			Stabilized arrangement		Other managed arrangement					
2011			Floating					Crawl-like arrangement		
2012			Crawl-like arrangement					Stabilized arrangement		
2013		Other managed arrangement	Floating	Crawl-like arrangement						
2014									Floating	Stabilized arrangement

Source: Annual Report on Exchange Rate Arrangement and Exchange Restriction, IMF

TABLE C2: EXCHANGE RATE REGIME DEFINITIONS

Exchange rate regime	Definitions
No separate legal tender	A country uses the currency of another country
Currency board	A monetary arrangement where a domestic currency is maintained at a fixed rate of exchange with another currency.
Conventional fixed	A country pegs its currency to another country or a basket of currencies at a fixed rate of exchange.
Peg with horizontal bands	The value of a currency is maintained within a band that is ± 1% from a fixed central rate, or the margin between the minimum and maximum exchange rate is over 2%.
Crawling pegs	The currency is adjusted periodically by a small amount from a fixed rate of exchange rate or according to changes of some indicators such as the previous inflation gap with its main trading partners.
Crawling band	Similar to the peg but with horizontal bands, the value of a currency is maintained within a fixed central rate with a ± 1% band or the margin between the minimum and maximum exchange rate is over 2%. However, the central rate is periodically adjusted at a fixed rate or according to changes of specified indicators.
Independent floating	The exchange rate is determined by the market rate. Official intervention in the foreign exchange market aims to prevent unnecessary changes and fluctuations of the exchange rate. In this regime, independent monetary policy may be applied.
Managed floating with no predetermined band	The monetary authorities manage the exchange rate without a certain target or path. Intervention is based on indicators such as the balance of payments position, international reserves, with intervention on the exchange rate conducted directly or indirectly.
Stabilised arrangement	This regime requires the spot exchange rate to remain within a margin of 2% in 6 months or more
Other managed arrangement	This includes exchange rate regimes not belonging to the other exchange rate regimes identified above.

Source: IMF (2006)

TABLE C3: DATA SOURCES

Variable	Source	Definition	Measurement
Consumer price index (p_{it})	Data for Laos and Vietnam: IFS, IMF[78].		Index
Exchange rate regime	AREAER[79] - IMF		Dummy variables
Foreign demand	WEO - IMF	Proxy by world real GDP growth	Percentage
Income per capita	WEO, IMF	GDP per capita, PPP	USD
Nominal GDP	WEO - IMF		National currency
Nominal exchange rate	IFS - IMF	Exchange rate to USD	Domestic currency/USD
Trade openness	World bank. Data for Brunei 2014 and Myanmar are taken from UNCTAD	Ratio between trade and GDP	Percentage
Within-country income gap	UNDP	Income Gini coefficient	Index

[78] International Financial Statistic
[79] Annual Report on Exchange Rate Arrangements and Exchange Restrictions

Figure C1: GRAPHS OF VARIABLES

Source: Author

TABLE C4: UNIT ROOT TEST

Table C4.1: Unit root test of foreign demand

At level
Null Hypothesis: Unit root (individual unit root process)
Series: W_OUTPUT
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Total (balanced) observations: 180
Cross-sections included: 10

Method		Statistic	Prob.**
Im, Pesaran and Shin W-stat		-7.84496	0.0000
Im, Pesaran and Shin t-bar		-3.84573	
T-bar critical values ***:	1% level	-2.22200	
	5% level	-2.00200	
	10% level	-1.89400	

** Probabilities are computed assuming asympotic normality
*** Critical values from original paper

Table C4.2: Unit root test of world real oil price

At level
Null Hypothesis: Unit root (individual unit root process)
Series: LOILP
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Total number of observations: 179
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-1.65708	0.0488

** Probabilities are computed assuming asympotic normality

Table C4.3: Unit root test of foreign real interest rate

At level
Null Hypothesis: Unit root (individual unit root process)
Series: WORLIR
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Total (balanced) observations: 180
Cross-sections included: 10

Method		Statistic	Prob.**
Im, Pesaran and Shin W-stat		-1.28680	0.0991
Im, Pesaran and Shin t-bar		-1.90048	
T-bar critical values ***:	1% level	-2.22200	
	5% level	-2.00200	
	10% level	-1.89400	

** Probabilities are computed assuming asympotic normality
*** Critical values from original paper

At first difference
Null Hypothesis: Unit root (individual unit root process)
Series: D(WORLIR)
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Total (balanced) observations: 170
Cross-sections included: 10

Method		Statistic	Prob.**
Im, Pesaran and Shin W-stat		-9.07972	0.0000
Im, Pesaran and Shin t-bar		-4.23232	
T-bar critical values ***:	1% level	-2.22800	
	5% level	-2.00800	
	10% level	-1.89600	

** Probabilities are computed assuming asympotic normality
*** Critical values from original paper

Table C4.4: Unit root test of real GDP

At level
Null Hypothesis: Unit root (individual unit root process)
Series: LREALGDP_NEW
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Total number of observations: 177
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	1.12676	0.8701

** Probabilities are computed assuming asympotic normality

At first difference
Null Hypothesis: Unit root (individual unit root process)
Series: D(LREALGDP_NEW)
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Total number of observations: 163
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-5.73632	0.0000

** Probabilities are computed assuming asympotic normality

Table C4.5: Unit root test of real exchange rate

At level

Null Hypothesis: Unit root (individual unit root process)
Series: LREALER
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Total number of observations: 172
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	0.70974	0.7611

** Probabilities are computed assuming asympotic normality

At first difference

Null Hypothesis: Unit root (individual unit root process)
Series: D(LREALER)
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Total (balanced) observations: 170
Cross-sections included: 10

Method		Statistic	Prob.**
Im, Pesaran and Shin W-stat		-4.67203	0.0000
Im, Pesaran and Shin t-bar		-2.91429	
T-bar critical values ***:	1% level	-2.22800	
	5% level	-2.00800	
	10% level	-1.89600	

** Probabilities are computed assuming asympotic normality
*** Critical values from original paper

Table C4.6: Unit root test of CPI

At level

Null Hypothesis: Unit root (individual unit root process)
Series: LCPI
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Total number of observations: 177
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-0.51028	0.3049

** Probabilities are computed assuming asympotic normality

At first difference
Null Hypothesis: Unit root (individual unit root process)
Series: D(LCPI)
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Total (balanced) observations: 170
Cross-sections included: 10

Method		Statistic	Prob.**
Im, Pesaran and Shin W-stat		-5.77012	0.0000
Im, Pesaran and Shin t-bar		-3.24265	
T-bar critical values ***:	1% level	-2.22800	
	5% level	-2.00800	
	10% level	-1.89600	

** Probabilities are computed assuming asympotic normality
*** Critical values from original paper

Table C4.7: Unit root test of between-countries income gap

At level
Null Hypothesis: Unit root (individual unit root process)
Series: IGPPP
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Total (balanced) observations: 180
Cross-sections included: 10

Method		Statistic	Prob.**
Im, Pesaran and Shin W-stat		4.68504	1.0000
Im, Pesaran and Shin t-bar		-0.12915	
T-bar critical values ***:	1% level	-2.22200	
	5% level	-2.00200	
	10% level	-1.89400	

** Probabilities are computed assuming asympotic normality
*** Critical values from original paper

At first difference
Null Hypothesis: Unit root (individual unit root process)
Series: D(IGPPP)
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Total number of observations: 169
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-7.19627	0.0000

** Probabilities are computed assuming asympotic normality

Table C4.8: Unit root test of within-country income gap

At level

Null Hypothesis: Unit root (individual unit root process)
Series: LINEQUALITY
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Total number of observations: 179
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-1.34418	0.0894

** Probabilities are computed assuming asympotic normality

At first difference

Null Hypothesis: Unit root (individual unit root process)
Series: D(LINEQUALITY)
Sample: 1999 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Total number of observations: 162
Cross-sections included: 10

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-4.79004	0.0000

** Probabilities are computed assuming asympotic normality

TABLE C5: COINTEGRATION TESTS FOR MODEL FOR BETWEEN-COUNTRIES INCOME GAP

Table C5.1: Dependent variable: Foreign real interest rate

Pedroni Residual Cointegration Test
Series: WORLIR LREALGDP_NEW LREALER LCPI IGPPP
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.575242	0.2826	0.586147	0.2789
Panel rho-Statistic	1.914856	0.9722	1.880274	0.9700
Panel PP-Statistic	0.583647	0.7203	0.538217	0.7048
Panel ADF-Statistic	-0.315616	0.3761	-0.198930	0.4212

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	3.341300	0.9996
Group PP-Statistic	1.535938	0.9377
Group ADF-Statistic	0.096669	0.5385

Table C5.2: Dependent variable: Real GDP

Pedroni Residual Cointegration Test
Series: LREALGDP_NEW LREALER LCPI IGPPP WORLIR
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.033993	0.5136	-0.164937	0.5655
Panel rho-Statistic	2.252576	0.9879	2.038905	0.9793
Panel PP-Statistic	0.515062	0.6967	0.264308	0.6042
Panel ADF-Statistic	1.570102	0.9418	-0.481489	0.3151

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	3.349273	0.9996
Group PP-Statistic	-2.281060	0.0113
Group ADF-Statistic	-2.383263	0.0086

Table C5.3: Dependent variable: Real exchange rate

Pedroni Residual Cointegration Test
Series: LREALER LCPI IGPPP WORLIR LREALGDP_NEW
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.085986	0.4657	0.370787	0.3554
Panel rho-Statistic	1.779311	0.9624	1.292882	0.9020
Panel PP-Statistic	-0.758720	0.2240	-1.801803	0.0358
Panel ADF-Statistic	-1.078402	0.1404	-2.110610	0.0174

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	2.625457	0.9957
Group PP-Statistic	-1.526717	0.0634
Group ADF-Statistic	-2.489318	0.0064

Table C5.4: Dependent variable: CPI

Pedroni Residual Cointegration Test
Series: LCPI IGPPP WORLIR LREALGDP_NEW LREALER
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.240893	0.4048	0.234194	0.4074
Panel rho-Statistic	1.388811	0.9176	1.349329	0.9114
Panel PP-Statistic	-0.996097	0.1596	-1.155391	0.1240
Panel ADF-Statistic	-1.768755	0.0385	-1.651968	0.0493

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	2.504884	0.9939
Group PP-Statistic	-1.526154	0.0635
Group ADF-Statistic	-2.745452	0.0030

Table C5.5: Dependent variable: Between-countries income gap

Pedroni Residual Cointegration Test
Series: IGPPP WORLIR LREALGDP_NEW LREALER LCPI
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.487682	0.6871	-0.956609	0.8306
Panel rho-Statistic	1.527935	0.9367	1.845823	0.9675
Panel PP-Statistic	-0.692474	0.2443	-0.114335	0.4545
Panel ADF-Statistic	-1.519839	0.0643	-0.948855	0.1713

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	3.025455	0.9988
Group PP-Statistic	-1.911918	0.0279
Group ADF-Statistic	-2.071361	0.0192

TABLE C6: COINTEGRATION TESTS FOR MODEL FOR WITHIN-COUNTRY INCOME GAP

Table C6.1: Dependent variable: Foreign real interest rate

Pedroni Residual Cointegration Test
Series: WORLIR LINEQUALITY LREALGDP_NEW LREALER LCPI
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.863354	0.1940	0.859061	0.1952
Panel rho-Statistic	1.242206	0.8929	1.156818	0.8763
Panel PP-Statistic	-0.828690	0.2036	-1.034254	0.1505
Panel ADF-Statistic	-1.666262	0.0478	-1.823969	0.0341

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	2.418833	0.9922
Group PP-Statistic	-0.500240	0.3085
Group ADF-Statistic	-1.913649	0.0278

Table C6.2: Dependent variable: Real GDP

Pedroni Residual Cointegration Test
Series: LREALGDP_NEW LREALER LCPI WORLIR LINEQUALITY
Date: 09/07/19 Time: 20:34
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.624130	0.2663	-0.449257	0.6734
Panel rho-Statistic	0.133923	0.5533	1.455678	0.9273
Panel PP-Statistic	-3.444604	0.0003	-0.617096	0.2686
Panel ADF-Statistic	-3.782049	0.0001	-1.200071	0.1151

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	2.687095	0.9964
Group PP-Statistic	-0.494616	0.3104
Group ADF-Statistic	-1.589522	0.0560

Table C6.3: Dependent variable: Real exchange rate

Pedroni Residual Cointegration Test
Series: LREALER LCPI WORLIR LINEQUALITY LREALGDP_NEW
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.349668	0.3633	-1.140214	0.8729
Panel rho-Statistic	2.429616	0.9924	1.386558	0.9172
Panel PP-Statistic	-0.847734	0.1983	-1.904880	0.0284
Panel ADF-Statistic	-4.514952	0.0000	-3.179896	0.0007

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	2.690946	0.9964
Group PP-Statistic	-1.774526	0.0380
Group ADF-Statistic	-3.604301	0.0002

Table C6.4: Dependent variable: CPI

Pedroni Residual Cointegration Test
Series: LCPI WORLIR LINEQUALITY LREALGDP_NEW LREALER
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	1.215643	0.1121	0.757796	0.2243
Panel rho-Statistic	0.357135	0.6395	0.891915	0.8138
Panel PP-Statistic	-3.804214	0.0001	-2.733674	0.0031
Panel ADF-Statistic	-3.917468	0.0000	-3.127294	0.0009

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.828747	0.9663
Group PP-Statistic	-4.518081	0.0000
Group ADF-Statistic	-4.219425	0.0000

Table C6.5: Dependent variable: Within-country income gap

Pedroni Residual Cointegration Test
Series: LINEQUALITY LREALGDP_NEW LREALER LCPI WORLIR
Sample: 1999 2017
Included observations: 190
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.280291	0.3896	0.257557	0.3984
Panel rho-Statistic	1.167920	0.8786	0.935945	0.8253
Panel PP-Statistic	-1.910354	0.0280	-2.069131	0.0193
Panel ADF-Statistic	-2.225603	0.0130	-1.806428	0.0354

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.795354	0.9637
Group PP-Statistic	-2.579658	0.0049
Group ADF-Statistic	-1.877652	0.0302

APPENDIX D: APPENDIX FOR CHAPTER 5

Table D1: VAR Lag Order Selection Criteria for foreign demand shock

VAR Lag Order Selection Criteria
Endogenous variables: W_OUTPUT DLREALGDP_NEW DLCPI DLREALER DIGPPP
Exogenous variables: C
Sample: 1999 2017
Included observations: 110

Lag	LogL	LR	FPE	AIC	SC	HQ
0	747.5209	NA	9.43e-13	-13.50038	-13.37763	-13.45059
1	806.6218	111.7544	5.08e-13*	-14.12040	-13.38390*	-13.82167*
2	821.8065	27.33243	6.08e-13	-13.94194	-12.59170	-13.39427
3	854.0207	55.05700	5.37e-13	-14.07310	-12.10912	-13.27650
4	881.3015	44.14524	5.22e-13	-14.11457	-11.53684	-13.06903
5	905.9467	37.64005	5.37e-13	-14.10812	-10.91665	-12.81364
6	931.7327	37.03802	5.47e-13	-14.12241	-10.31719	-12.57899
7	960.9449	39.30366*	5.31e-13	-14.19900*	-9.780030	-12.40664

* indicates lag order selected by the criterion

1 lag

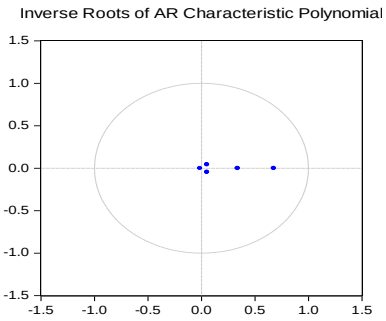


Figure D1: Stability test – Foreign demand shock

Table D2: VAR Lag Order Selection Criteria for world real oil price shock

VAR Lag Order Selection Criteria
Endogenous variables: LOILP DLREALGDP_NEW DLCPI DLREALER DIGPPP
Exogenous variables: C
Sample: 1999 2017
Included observations: 110

Lag	LogL	LR	FPE	AIC	SC	HQ
0	143.2138	NA	5.58e-08	-2.512979	-2.390230	-2.463191
1	471.9201	621.5536	2.23e-10	-8.034910	-7.298416*	-7.736184*
2	480.1014	14.72647	3.04e-10	-7.729117	-6.378877	-7.181452
3	514.2745	58.40491	2.59e-10	-7.895900	-5.931915	-7.099297
4	544.5518	48.99409	2.38e-10	-7.991850	-5.414119	-6.946309
5	583.9064	60.10524	1.88e-10	-8.252844	-5.061367	-6.958363
6	624.3118	58.03682	1.47e-10	-8.532941	-4.727719	-6.989523
7	673.1406	65.69698*	9.95e-11*	-8.966193*	-4.547225	-7.173836

* indicates lag order selected by the criterion

1 lags **7 lags**

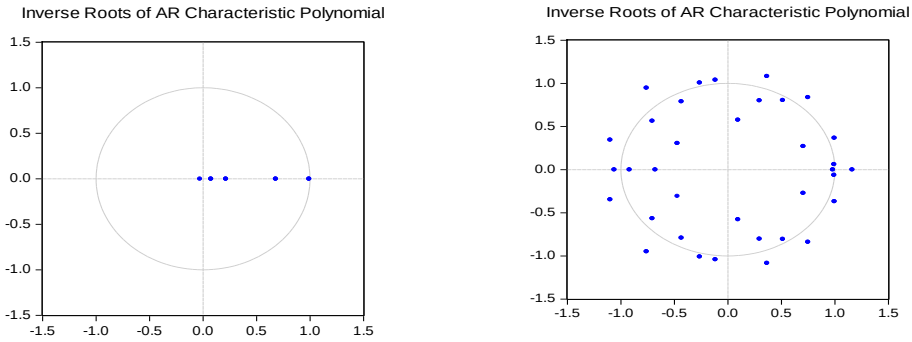


Figure D2: Stability test - World real oil price shock

Table D3: VAR Lag Order Selection Criteria for foreign interest rate shock with maximum of 7 lags

VAR Lag Order Selection Criteria
Endogenous variables: D(WORLIR) DLREALGDP_NEW DLCPI DLREALER DIGPPP
Exogenous variables: C
Sample: 1999 2017
Included observations: 110

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1292.043	NA	4.73e-17	-23.40078	-23.27803*	-23.35099
1	1341.025	92.62116	3.06e-17	-23.83682	-23.10033	-23.53810
2	1351.395	18.66608	4.00e-17	-23.57082	-22.22058	-23.02316
3	1384.490	56.56197	3.48e-17	-23.71800	-21.75402	-22.92140
4	1441.115	91.62947	1.98e-17	-24.29300	-21.71527	-23.24746
5	1473.281	49.12628	1.78e-17	-24.42329	-21.23182	-23.12881
6	1551.683	112.6139	6.97e-18	-25.39424	-21.58902	-23.85082
7	1598.926	63.56362*	4.87e-18*	-25.79866*	-21.37969	-24.00630*

* indicates lag order selected by the criterion

Table D4: VAR Lag Order Selection Criteria for foreign interest rate shock, maximum 6 lags

VAR Lag Order Selection Criteria
Endogenous variables: D(WORLIR) DLREALGDP_NEW DLCPI DLREALER DIGPPP
Exogenous variables: C
Sample: 1999 2017
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1412.569	NA	4.46e-17	-23.45948	-23.34334*	-23.41232
1	1467.999	105.3170	2.69e-17	-23.96665	-23.26978	-23.68365
2	1481.494	24.51542	3.26e-17	-23.77490	-22.49730	-23.25606
3	1518.175	63.58153	2.70e-17	-23.96959	-22.11126	-23.21491
4	1579.317	100.8833	1.49e-17	-24.57195	-22.13289	-23.58144
5	1616.051	57.54998	1.25e-17	-24.76751	-21.74773	-23.54117
6	1664.724	72.19781*	8.63e-18*	-25.16206*	-21.56155	-23.69987*

* indicates lag order selected by the criterion

Table D5: VAR Lag Order Selection Criteria for foreign interest rate shock, maximum 5 lags

VAR Lag Order Selection Criteria
Endogenous variables: D(WORLIR) DLREALGDP_NEW DLCPI DLREALER DIGPPP
Exogenous variables: C
Sample: 1999 2017
Included observations: 130

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1542.011	NA	3.70e-17	-23.64632	-23.53603	-23.60151
1	1602.941	116.2354	2.13e-17	-24.19909	-23.53735*	-23.93020
2	1613.530	19.38734	2.66e-17	-23.97739	-22.76420	-23.48443
3	1655.460	73.53724	2.06e-17	-24.23784	-22.47320	-23.52081
4	1725.765	117.8963	1.03e-17	-24.93484	-22.61876	-23.99374*
5	1762.666	59.04277*	8.73e-18*	-25.11795*	-22.25041	-23.95277

* indicates lag order selected by the criterion

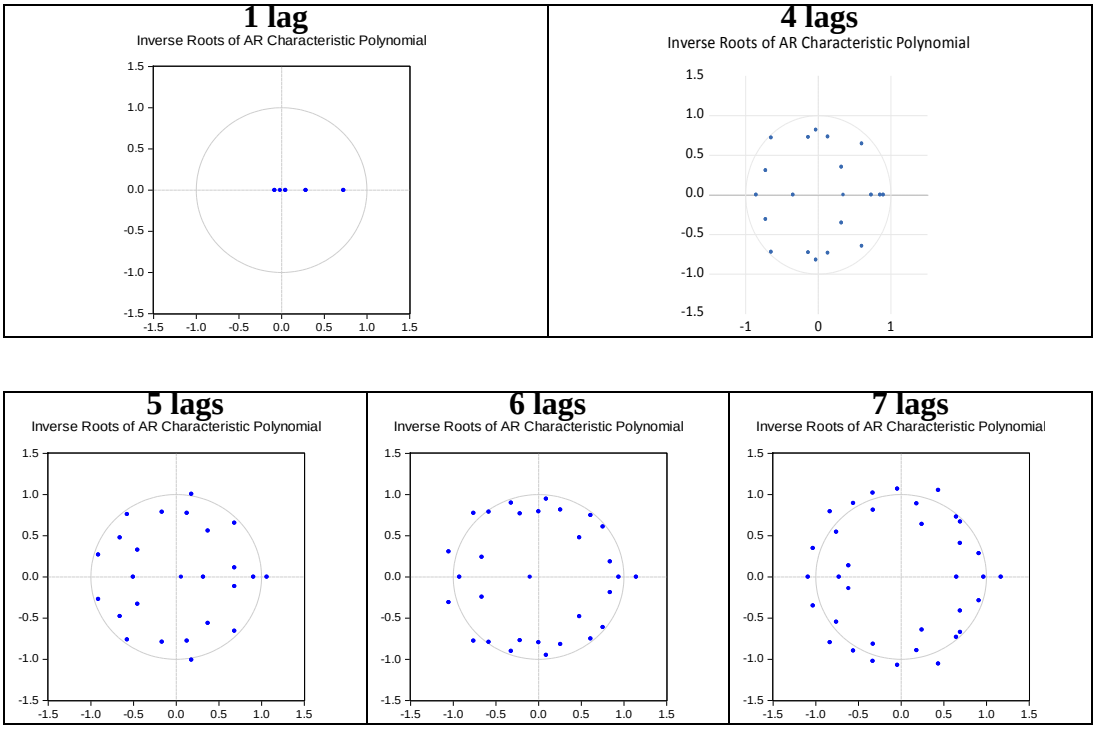


Figure D3: Stability test- foreign interest rate shock

Table D6: Impulse responses to a negative foreign demand shock under a fixed exchange rate regime

Period	DLREALGDP_NEW*(ERR2=0)	DLCPI*(ERR2=0)	DLREALER*(ERR2=0)	DIGPPP*(ERR2=0)
1	-0.001925	-0.005514	0.005620	0.000648
	(0.00068)	(0.00061)	(0.00088)	(0.00068)
2	-0.000528	-0.003976	0.002931	0.000326
	(0.00057)	(0.00056)	(0.00077)	(0.00056)
3	8.37E-05	-0.002553	0.000999	0.000745
	(0.00048)	(0.00058)	(0.00074)	(0.00055)
4	-0.000113	-0.001524	-3.17E-05	0.000923
	(0.00035)	(0.00054)	(0.00062)	(0.00053)
5	-0.000248	-0.000889	-0.000407	0.000999
	(0.00026)	(0.00046)	(0.00050)	(0.00050)
6	-0.000240	-0.000520	-0.000499	0.001007
	(0.00019)	(0.00040)	(0.00042)	(0.00046)
7	-0.000183	-0.000305	-0.000503	0.000965
	(0.00016)	(0.00034)	(0.00036)	(0.00043)
8	-0.000130	-0.000176	-0.000481	0.000893
	(0.00014)	(0.00029)	(0.00032)	(0.00040)
9	-9.47E-05	-9.68E-05	-0.000449	0.000807
	(0.00012)	(0.00025)	(0.00029)	(0.00038)
10	-7.26E-05	-4.85E-05	-0.000411	0.000718
	(0.00010)	(0.00022)	(0.00026)	(0.00035)
11	-5.78E-05	-1.97E-05	-0.000369	0.000632
	(9.1E-05)	(0.00019)	(0.00024)	(0.00033)
12	-4.71E-05	-3.08E-06	-0.000327	0.000553
	(7.9E-05)	(0.00017)	(0.00022)	(0.00030)
13	-3.88E-05	6.04E-06	-0.000287	0.000482
	(6.9E-05)	(0.00015)	(0.00019)	(0.00028)
14	-3.23E-05	1.06E-05	-0.000251	0.000418
	(6.1E-05)	(0.00013)	(0.00018)	(0.00026)
15	-2.71E-05	1.26E-05	-0.000218	0.000362
	(5.3E-05)	(0.00011)	(0.00016)	(0.00023)
16	-2.29E-05	1.29E-05	-0.000189	0.000313
	(4.6E-05)	(9.7E-05)	(0.00014)	(0.00021)
17	-1.94E-05	1.25E-05	-0.000164	0.000270
	(4.0E-05)	(8.4E-05)	(0.00013)	(0.00020)
18	-1.65E-05	1.16E-05	-0.000142	0.000233
	(3.5E-05)	(7.2E-05)	(0.00011)	(0.00018)
19	-1.41E-05	1.05E-05	-0.000122	0.000201
	(3.1E-05)	(6.3E-05)	(0.00010)	(0.00016)
20	-1.21E-05	9.36E-06	-0.000105	0.000173
	(2.7E-05)	(5.4E-05)	(9.3E-05)	(0.00015)

Factorization: Structural
Standard Errors: Analytic

Table D7: Impulse responses to a negative foreign demand shock under a flexible exchange rate regime

Period	DLREALGDP_NEW*(ERR2=1)	DLCPI*(ERR2=1)	DLREALER*(ERR2=1)	DIGPPP*(ERR2=1)
1	-0.002107	-0.014217	0.027315	0.000360
	(0.00818)	(0.00364)	(0.02897)	(0.00203)
2	-0.000720	-0.007159	-0.013265	-0.005303
	(0.00716)	(0.00378)	(0.02491)	(0.00191)
3	-0.000559	-0.006580	-0.002473	-0.004569
	(0.00417)	(0.00335)	(0.01339)	(0.00148)
4	0.000745	-0.005579	0.001429	-0.003230
	(0.00286)	(0.00281)	(0.00822)	(0.00118)
5	0.001196	-0.004344	0.002314	-0.002203
	(0.00202)	(0.00225)	(0.00537)	(0.00094)
6	0.001173	-0.003208	0.002217	-0.001482
	(0.00144)	(0.00175)	(0.00362)	(0.00072)
7	0.000977	-0.002288	0.001823	-0.000988
	(0.00103)	(0.00134)	(0.00248)	(0.00055)
8	0.000750	-0.001593	0.001390	-0.000653
	(0.00073)	(0.00100)	(0.00171)	(0.00041)
9	0.000549	-0.001090	0.001013	-0.000429
	(0.00052)	(0.00074)	(0.00118)	(0.00030)
10	0.000389	-0.000735	0.000716	-0.000280
	(0.00037)	(0.00054)	(0.00082)	(0.00022)
11	0.000270	-0.000491	0.000495	-0.000182
	(0.00026)	(0.00040)	(0.00056)	(0.00016)
12	0.000184	-0.000325	0.000337	-0.000118
	(0.00018)	(0.00028)	(0.00039)	(0.00011)
13	0.000124	-0.000214	0.000227	-7.61E-05
	(0.00013)	(0.00020)	(0.00027)	(8.0E-05)
14	8.26E-05	-0.000140	0.000151	-4.90E-05
	(8.9E-05)	(0.00014)	(0.00018)	(5.6E-05)
15	5.46E-05	-9.11E-05	9.96E-05	-3.15E-05
	(6.2E-05)	(0.00010)	(0.00012)	(4.0E-05)
16	3.59E-05	-5.90E-05	6.54E-05	-2.02E-05
	(4.3E-05)	(7.1E-05)	(8.5E-05)	(2.8E-05)
17	2.34E-05	-3.82E-05	4.27E-05	-1.29E-05
	(3.0E-05)	(5.0E-05)	(5.8E-05)	(1.9E-05)
18	1.52E-05	-2.46E-05	2.78E-05	-8.25E-06
	(2.1E-05)	(3.5E-05)	(4.0E-05)	(1.3E-05)
19	9.87E-06	-1.58E-05	1.80E-05	-5.27E-06
	(1.4E-05)	(2.4E-05)	(2.7E-05)	(9.1E-06)
20	6.37E-06	-1.01E-05	1.16E-05	-3.36E-06
	(9.7E-06)	(1.6E-05)	(1.8E-05)	(6.2E-06)

Factorization: Structural
Standard Errors: Analytic

Table D8: Impulse responses to a positive world real oil price shock under a fixed exchange rate regime

Period	DLREALGDP_NEW*(ERR2=0)	DLCPI*(ERR2=0)	DLREALER*(ERR2=0)	DIGPPP*(ERR2=0)
1	0.000204	0.007744	-0.003769	0.003862
	(0.00071)	(0.00053)	(0.00091)	(0.00061)
2	0.000146	0.004576	-0.001755	0.001179
	(0.00057)	(0.00058)	(0.00085)	(0.00059)
3	0.000340	0.002744	-0.000708	-4.56E-05
	(0.00044)	(0.00061)	(0.00080)	(0.00059)
4	0.000337	0.001719	-0.000289	-0.000691
	(0.00033)	(0.00055)	(0.00067)	(0.00056)
5	0.000272	0.001148	-0.000131	-0.000992
	(0.00026)	(0.00047)	(0.00053)	(0.00053)
6	0.000206	0.000825	-7.22E-05	-0.001097
	(0.00021)	(0.00040)	(0.00043)	(0.00051)
7	0.000155	0.000635	-5.05E-05	-0.001099
	(0.00018)	(0.00036)	(0.00037)	(0.00048)
8	0.000120	0.000516	-4.16E-05	-0.001051
	(0.00016)	(0.00032)	(0.00033)	(0.00047)
9	9.64E-05	0.000437	-3.69E-05	-0.000980
	(0.00015)	(0.00030)	(0.00029)	(0.00045)
10	8.01E-05	0.000380	-3.34E-05	-0.000901
	(0.00013)	(0.00028)	(0.00027)	(0.00043)
11	6.85E-05	0.000336	-3.05E-05	-0.000823
	(0.00012)	(0.00026)	(0.00024)	(0.00042)
12	5.98E-05	0.000299	-2.77E-05	-0.000748
	(0.00011)	(0.00024)	(0.00022)	(0.00040)
13	5.29E-05	0.000269	-2.52E-05	-0.000679
	(0.00010)	(0.00022)	(0.00020)	(0.00039)
14	4.72E-05	0.000242	-2.28E-05	-0.000615
	(9.2E-05)	(0.00021)	(0.00018)	(0.00037)
15	4.24E-05	0.000218	-2.07E-05	-0.000557
	(8.4E-05)	(0.00019)	(0.00016)	(0.00036)
16	3.82E-05	0.000197	-1.87E-05	-0.000504
	(7.6E-05)	(0.00018)	(0.00015)	(0.00034)
17	3.44E-05	0.000178	-1.69E-05	-0.000456
	(7.0E-05)	(0.00017)	(0.00013)	(0.00032)
18	3.11E-05	0.000161	-1.53E-05	-0.000412
	(6.3E-05)	(0.00016)	(0.00012)	(0.00031)
19	2.81E-05	0.000145	-1.38E-05	-0.000373
	(5.8E-05)	(0.00015)	(0.00011)	(0.00029)
20	2.54E-05	0.000131	-1.25E-05	-0.000337
	(5.3E-05)	(0.00014)	(9.7E-05)	(0.00028)

Factorization: Structural
Standard Errors: Analytic

Table D9: Impulse responses to a positive world real oil price shock under a flexible exchange rate regime

Period	DLREALGDP_NEW*(ERR2=1)	DLCPI*(ERR2=1)	DLREALER*(ERR2=1)	DIGPPP*(ERR2=1)
1	-0.010573	0.018357	0.063994	0.006046
	(0.00814)	(0.00358)	(0.02886)	(0.00203)
2	-0.004208	0.011851	-0.006040	0.005649
	(0.00407)	(0.00265)	(0.01359)	(0.00119)
3	-0.001340	0.008102	-0.008185	0.004240
	(0.00334)	(0.00250)	(0.01104)	(0.00108)
4	9.84E-05	0.005541	-0.005798	0.003289
	(0.00304)	(0.00249)	(0.00972)	(0.00105)
5	0.000986	0.003855	-0.004004	0.002655
	(0.00282)	(0.00245)	(0.00879)	(0.00102)
6	0.001491	0.002753	-0.002825	0.002211
	(0.00264)	(0.00239)	(0.00807)	(0.00099)
7	0.001746	0.002028	-0.002053	0.001889
	(0.00247)	(0.00230)	(0.00746)	(0.00095)
8	0.001846	0.001545	-0.001542	0.001646
	(0.00230)	(0.00219)	(0.00691)	(0.00091)
9	0.001852	0.001218	-0.001199	0.001456
	(0.00215)	(0.00208)	(0.00639)	(0.00087)
10	0.001802	0.000991	-0.000963	0.001304
	(0.00200)	(0.00196)	(0.00591)	(0.00083)
11	0.001722	0.000830	-0.000798	0.001177
	(0.00186)	(0.00183)	(0.00547)	(0.00079)
12	0.001626	0.000712	-0.000678	0.001069
	(0.00173)	(0.00171)	(0.00505)	(0.00075)
13	0.001523	0.000623	-0.000588	0.000976
	(0.00160)	(0.00160)	(0.00466)	(0.00071)
14	0.001419	0.000552	-0.000519	0.000893
	(0.00149)	(0.00149)	(0.00430)	(0.00067)
15	0.001318	0.000495	-0.000464	0.000819
	(0.00138)	(0.00138)	(0.00396)	(0.00064)
16	0.001221	0.000448	-0.000418	0.000752
	(0.00128)	(0.00128)	(0.00365)	(0.00060)
17	0.001129	0.000407	-0.000379	0.000692
	(0.00119)	(0.00119)	(0.00337)	(0.00057)
18	0.001043	0.000372	-0.000346	0.000636
	(0.00110)	(0.00110)	(0.00310)	(0.00054)
19	0.000963	0.000340	-0.000316	0.000586
	(0.00103)	(0.00102)	(0.00286)	(0.00051)
20	0.000888	0.000312	-0.000290	0.000539
	(0.00095)	(0.00094)	(0.00263)	(0.00048)

Factorization: Structural
Standard Errors: Analytic

Table D10: Impulse responses to a positive foreign real interest rate shock under a fixed exchange rate regime

Period	DLREALGDP_NEW*(ERR2=0)	DLCPI*(ERR2=0)	DLREALER*(ERR2=0)	DIGPPP*(ERR2=0)
1	-0.000355	0.000575	0.003786	-0.000683
	(0.00064)	(0.00067)	(0.00087)	(0.00073)
2	-0.003475	0.000906	-0.001251	-0.001123
	(0.00069)	(0.00077)	(0.00103)	(0.00080)
3	-0.000301	0.000291	0.000281	1.86E-06
	(0.00042)	(0.00052)	(0.00067)	(0.00049)
4	-3.85E-05	0.000126	0.000155	-4.65E-05
	(0.00026)	(0.00035)	(0.00041)	(0.00034)
5	8.40E-05	4.97E-05	0.000128	-6.45E-05
	(0.00022)	(0.00022)	(0.00025)	(0.00025)
6	8.75E-05	2.38E-05	8.51E-05	-7.69E-05
	(0.00018)	(0.00013)	(0.00015)	(0.00020)
7	7.59E-05	1.47E-05	5.95E-05	-7.29E-05
	(0.00014)	(8.2E-05)	(0.00010)	(0.00016)
8	6.18E-05	1.14E-05	4.30E-05	-6.32E-05
	(0.00011)	(5.2E-05)	(7.7E-05)	(0.00012)
9	4.98E-05	9.78E-06	3.23E-05	-5.26E-05
	(9.2E-05)	(3.5E-05)	(5.9E-05)	(0.00010)
10	4.00E-05	8.56E-06	2.50E-05	-4.29E-05
	(7.4E-05)	(2.7E-05)	(4.7E-05)	(8.0E-05)
11	3.22E-05	7.41E-06	1.96E-05	-3.47E-05
	(6.0E-05)	(2.1E-05)	(3.8E-05)	(6.5E-05)
12	2.60E-05	6.33E-06	1.56E-05	-2.81E-05
	(4.8E-05)	(1.7E-05)	(3.1E-05)	(5.2E-05)
13	2.10E-05	5.32E-06	1.25E-05	-2.27E-05
	(3.9E-05)	(1.4E-05)	(2.5E-05)	(4.2E-05)
14	1.70E-05	4.43E-06	1.01E-05	-1.83E-05
	(3.2E-05)	(1.2E-05)	(2.1E-05)	(3.5E-05)
15	1.38E-05	3.66E-06	8.17E-06	-1.48E-05
	(2.6E-05)	(9.6E-06)	(1.7E-05)	(2.8E-05)
16	1.12E-05	3.01E-06	6.61E-06	-1.20E-05
	(2.1E-05)	(7.9E-06)	(1.4E-05)	(2.3E-05)
17	9.09E-06	2.46E-06	5.36E-06	-9.75E-06
	(1.7E-05)	(6.5E-06)	(1.1E-05)	(1.9E-05)
18	7.38E-06	2.01E-06	4.34E-06	-7.91E-06
	(1.4E-05)	(5.3E-06)	(9.2E-06)	(1.5E-05)
19	5.99E-06	1.64E-06	3.52E-06	-6.42E-06
	(1.1E-05)	(4.3E-06)	(7.5E-06)	(1.2E-05)
20	4.86E-06	1.33E-06	2.86E-06	-5.21E-06
	(9.3E-06)	(3.5E-06)	(6.1E-06)	(1.0E-05)

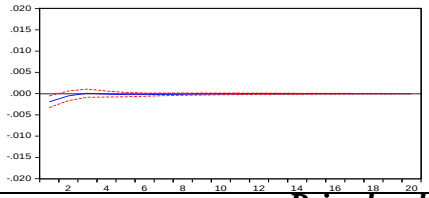
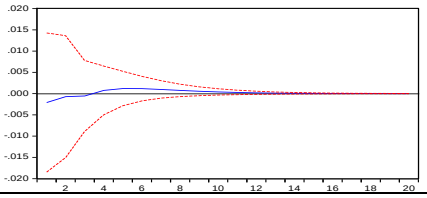
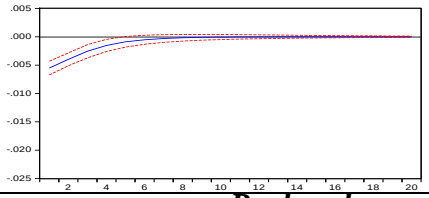
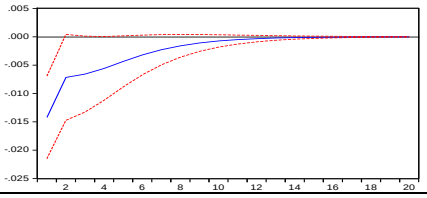
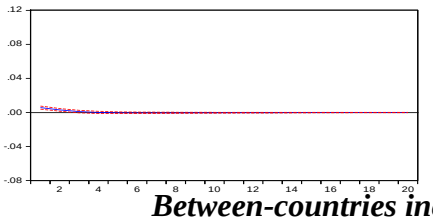
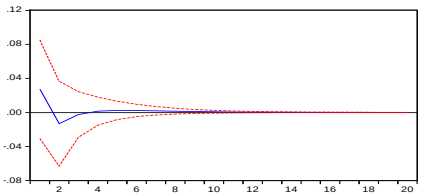
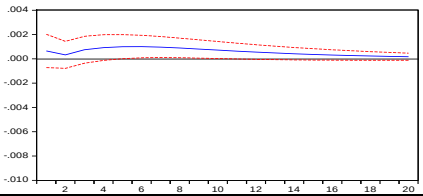
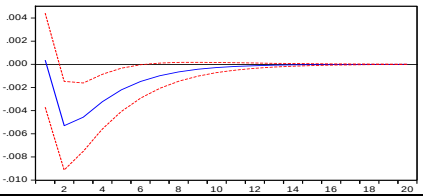
Factorization: Structural
Standard Errors: Analytic

Table D11: Impulse responses to a positive foreign real interest rate shock under a flexible exchange rate regime

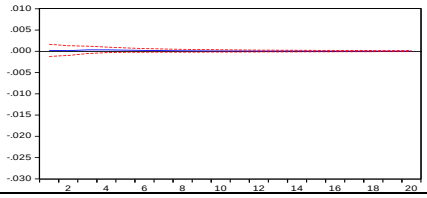
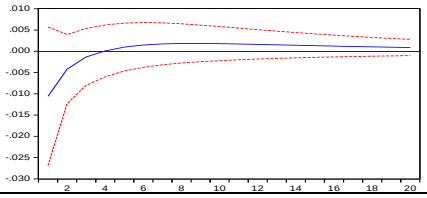
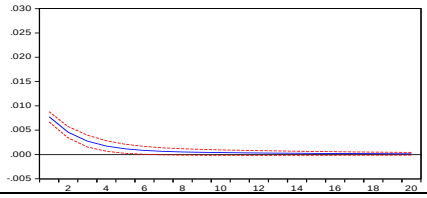
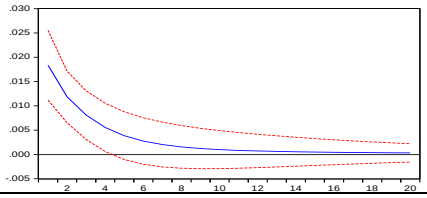
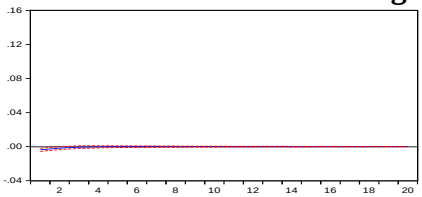
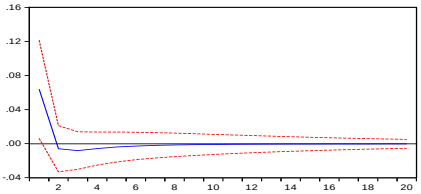
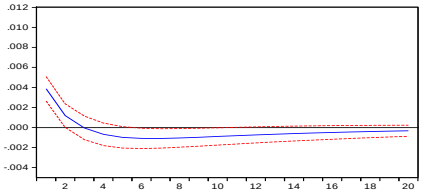
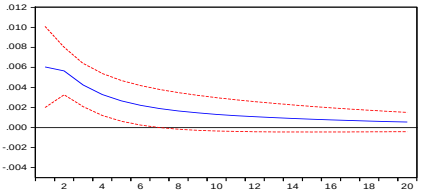
Period	DLREALGDP_NEW*(ERR2=1)	DLCPI*(ERR2=1)	DLREALER*(ERR2=1)	DIGPPP*(ERR2=1)
1	0.020587	-0.015628	0.036207	0.004329
	(0.00812)	(0.00359)	(0.02886)	(0.00206)
2	0.001843	6.91E-05	-0.029528	-0.000652
	(0.00849)	(0.00431)	(0.02963)	(0.00228)
3	0.000465	-0.001126	0.002193	-0.000440
	(0.00178)	(0.00235)	(0.00461)	(0.00089)
4	0.000413	-0.000725	0.000782	-0.000261
	(0.00099)	(0.00159)	(0.00212)	(0.00054)
5	0.000295	-0.000491	0.000612	-0.000166
	(0.00066)	(0.00106)	(0.00137)	(0.00035)
6	0.000200	-0.000326	0.000404	-0.000108
	(0.00044)	(0.00070)	(0.00091)	(0.00023)
7	0.000133	-0.000216	0.000268	-7.10E-05
	(0.00029)	(0.00047)	(0.00060)	(0.00015)
8	8.83E-05	-0.000143	0.000177	-4.68E-05
	(0.00020)	(0.00031)	(0.00040)	(0.00010)
9	5.84E-05	-9.43E-05	0.000117	-3.09E-05
	(0.00013)	(0.00021)	(0.00027)	(6.8E-05)
10	3.86E-05	-6.23E-05	7.74E-05	-2.04E-05
	(8.7E-05)	(0.00014)	(0.00018)	(4.6E-05)
11	2.55E-05	-4.12E-05	5.12E-05	-1.35E-05
	(5.8E-05)	(9.2E-05)	(0.00012)	(3.1E-05)
12	1.69E-05	-2.72E-05	3.38E-05	-8.93E-06
	(3.9E-05)	(6.2E-05)	(7.9E-05)	(2.0E-05)
13	1.11E-05	-1.80E-05	2.23E-05	-5.90E-06
	(2.6E-05)	(4.1E-05)	(5.3E-05)	(1.4E-05)
14	7.36E-06	-1.19E-05	1.48E-05	-3.90E-06
	(1.7E-05)	(2.8E-05)	(3.5E-05)	(9.2E-06)
15	4.87E-06	-7.85E-06	9.76E-06	-2.58E-06
	(1.2E-05)	(1.9E-05)	(2.4E-05)	(6.2E-06)
16	3.22E-06	-5.19E-06	6.45E-06	-1.70E-06
	(7.8E-06)	(1.3E-05)	(1.6E-05)	(4.1E-06)
17	2.13E-06	-3.43E-06	4.26E-06	-1.13E-06
	(5.3E-06)	(8.4E-06)	(1.1E-05)	(2.8E-06)
18	1.40E-06	-2.27E-06	2.82E-06	-7.44E-07
	(3.5E-06)	(5.7E-06)	(7.1E-06)	(1.9E-06)
19	9.28E-07	-1.50E-06	1.86E-06	-4.91E-07
	(2.4E-06)	(3.8E-06)	(4.8E-06)	(1.3E-06)
20	6.13E-07	-9.90E-07	1.23E-06	-3.25E-07
	(1.6E-06)	(2.6E-06)	(3.2E-06)	(8.5E-07)

Factorization: Structural
Standard Errors: Analytic

A negative foreign demand shock

	Fixed ERR	Flexible ERR
	Real GDP	
Impulse response		
	Price level	
Impulse response		
	Real exchange rate	
Impulse response		
	Between-countries income gap	
Impulse response		

A positive world real oil price shock

	Fixed ERR	Flexible ERR
	Real GDP	
Impulse response		
	Price level	
Impulse response		
	Real exchange rate	
Impulse response		
	Between-countries income gap	
Impulse response		

A positive foreign real interest rate shock

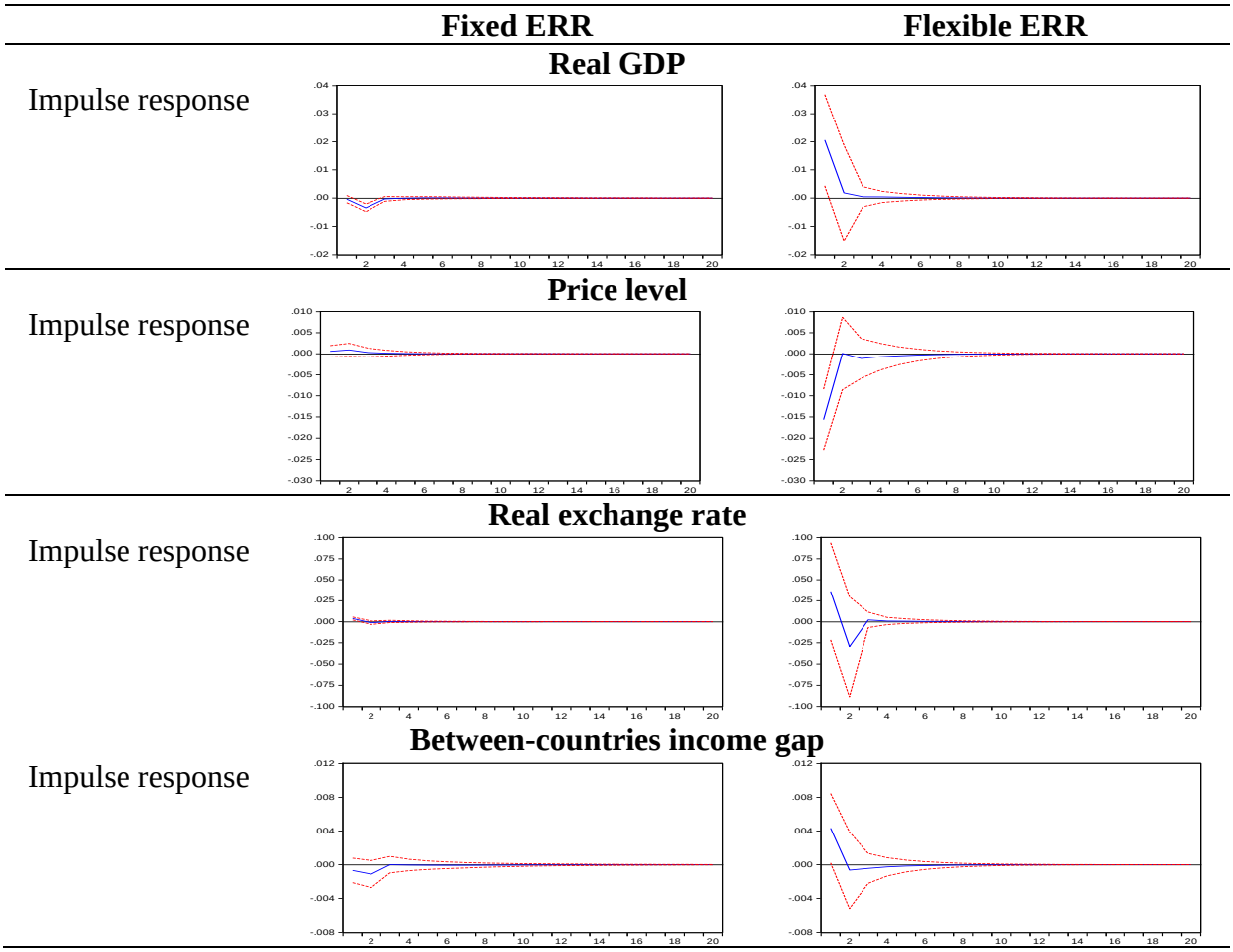
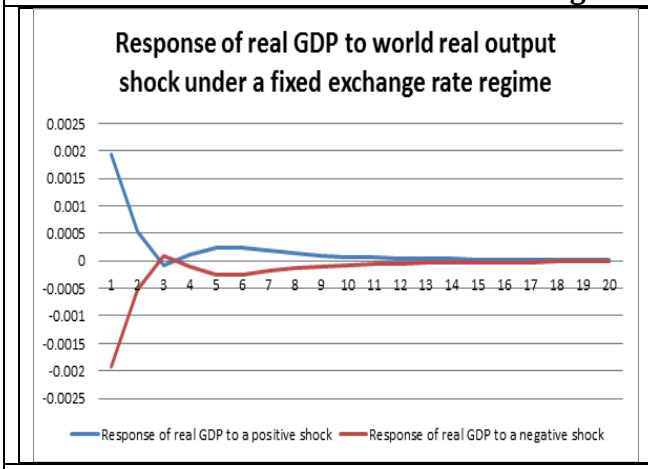
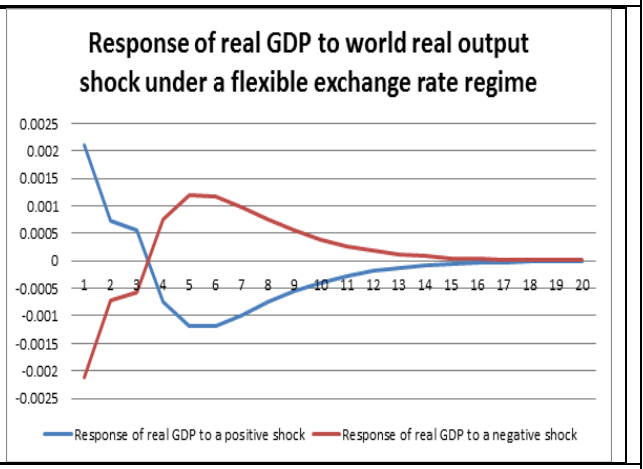


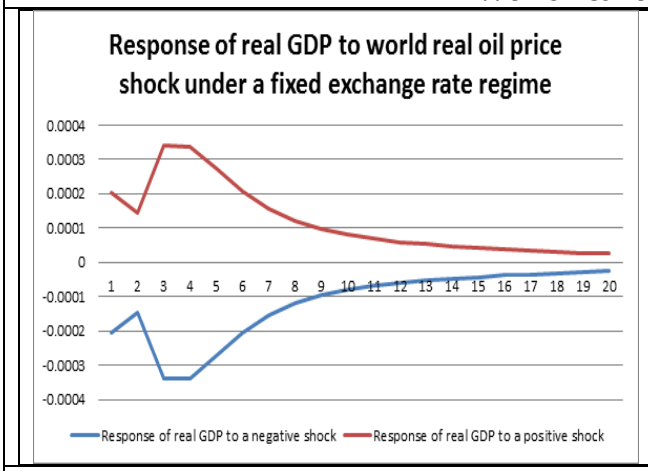
Figure D4: Robustness test with changing on restrictions

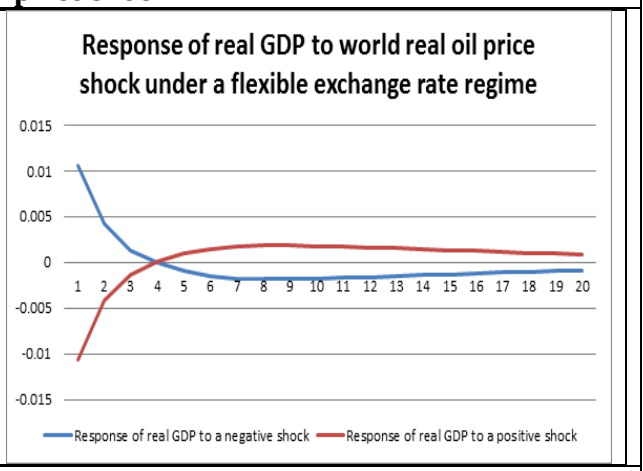
Foreign demand shock



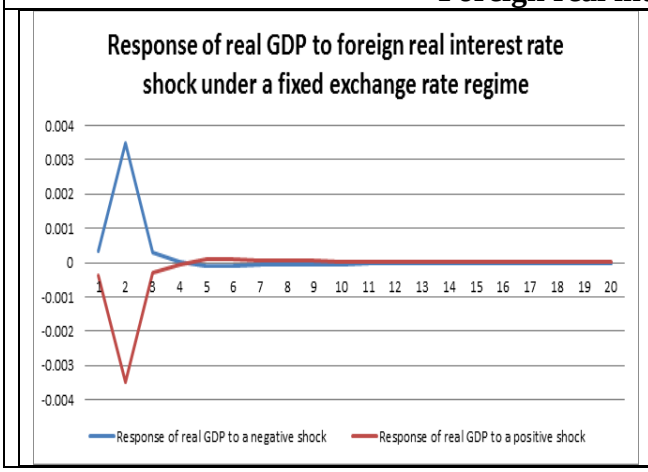


World real oil price shock





Foreign real interest rate shock



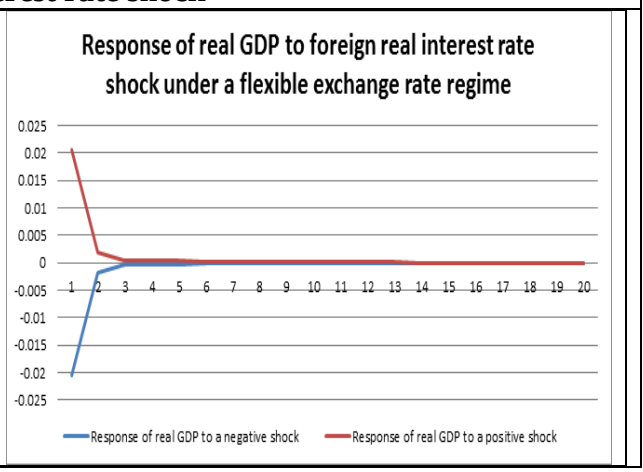


Figure D6: Responses of real GDP to negative and positive shocks for model of between-country income gap

APPENDIX E: APPENDIX FOR CHAPTER 6

Table E1: VAR Lag Order Selection Criteria for foreign demand shock

VAR Lag Order Selection Criteria
Endogenous variables: W_OUTPUT DLREALGDP_NEW DLCPI DLREALER DLINEQUALITY
Exogenous variables: C
Sample: 1999 2017
Included observations: 110

Lag	LogL	LR	FPE	AIC	SC	HQ
0	900.1298	NA	5.88e-14	-16.27509	-16.15234*	-16.22530
1	950.1763	94.63337	3.73e-14*	-16.73048*	-15.99398	-16.43175*
2	969.4662	34.72177	4.15e-14	-16.62666	-15.27642	-16.07899
3	993.1560	40.48802	4.28e-14	-16.60284	-14.63885	-15.80623
4	1012.836	31.84660	4.78e-14	-16.50612	-13.92839	-15.46058
5	1044.500	48.35939*	4.33e-14	-16.62728	-13.43580	-15.33280
6	1067.148	32.53001	4.67e-14	-16.58451	-12.77928	-15.04109
7	1092.718	34.40290	4.84e-14	-16.59486	-12.17590	-14.80251

* indicates lag order selected by the criterion

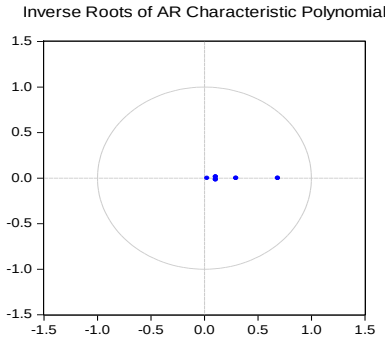


Figure E1: Stability test with 1 lag - foreign demand shock

Table E2: VAR Lag Order Selection Criteria for world real oil price shock

VAR Lag Order Selection Criteria
Endogenous variables: LOILP DLREALGDP_NEW DLCPI DLREALER DLINEQUALITY
Exogenous variables: C
Sample: 1999 2017
Included observations: 110

Lag	LogL	LR	FPE	AIC	SC	HQ
0	293.6429	NA	3.62e-09	-5.248052	-5.125303	-5.198264
1	616.1287	609.7915	1.62e-11	-10.65689	-9.920392*	-10.35816*
2	630.0439	25.04723	1.99e-11	-10.45534	-9.105103	-9.907678
3	654.3699	41.57543	2.03e-11	-10.44309	-8.479104	-9.646486
4	681.9729	44.66665	1.96e-11	-10.49042	-7.912685	-9.444875
5	711.3146	44.81271	1.85e-11	-10.56936	-7.377879	-9.274875
6	733.5461	31.93260	2.01e-11	-10.51902	-6.713798	-8.975602
7	780.0018	62.50404*	1.43e-11*	-10.90912*	-6.490156	-9.116767

* indicates lag order selected by the criterion

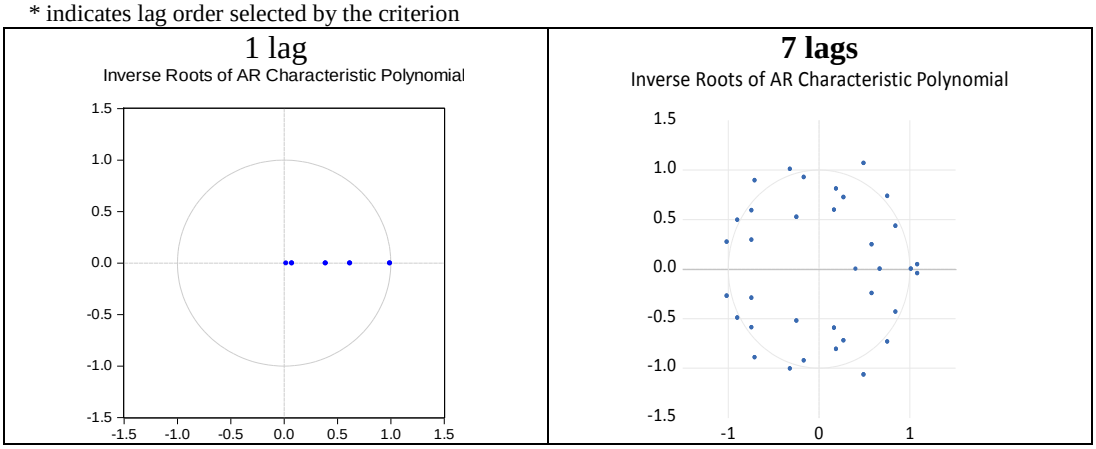


Figure E2: Stability test - world real oil price shock

Table E3: VAR Lag Order Selection Criteria for foreign interest rate shock

VAR Lag Order Selection Criteria
Endogenous variables: D_WORLIR DLREALGDP_NEW DLCPI DLREALER DLINEQUALITY
Exogenous variables: C
Sample: 1999 2017
Included observations: 110

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1444.068	NA	2.98e-18	-26.16487	-26.04212*	-26.11508
1	1489.960	86.77861	2.04e-18	-26.54473	-25.80824	-26.24601*
2	1507.213	31.05431	2.36e-18	-26.40387	-25.05363	-25.85620
3	1525.720	31.63132	2.67e-18	-26.28582	-24.32184	-25.48922
4	1569.914	71.51364	1.91e-18	-26.63480	-24.05707	-25.58926
5	1617.123	72.10081	1.30e-18	-27.03860	-23.84712	-25.74412
6	1668.242	73.42515	8.37e-19	-27.51349	-23.70827	-25.97007
7	1696.950	38.62540*	8.20e-19*	-27.58091*	-23.16194	-25.78855

* indicates lag order selected by the criterion

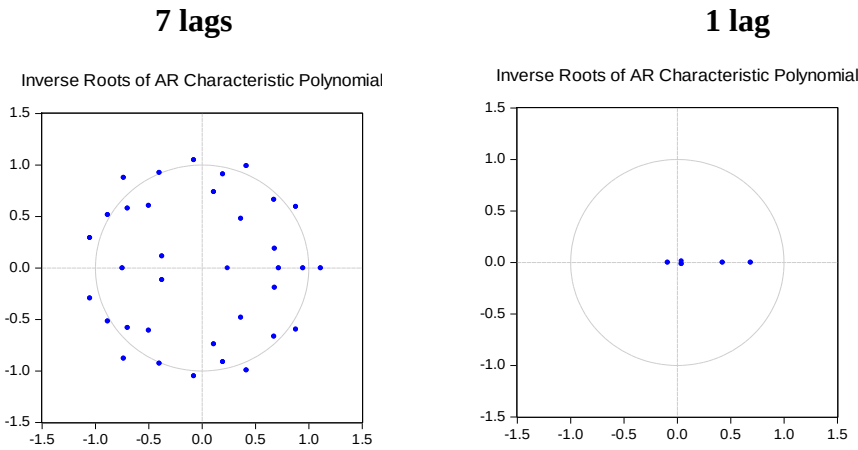


Figure E3: Stability test- foreign interest rate shock

Table E4: Impulse responses to a negative foreign demand shock under a fixed exchange rate regime

Period	DLREALGDP_NEW*(ERR2=0)	DLCPI*(ERR2=0)	DLREALER*(ERR2=0)	DLINEQUALITY*(ERR2=0)
1	-0.003752	-0.005359	0.005650	-0.001385
	(0.00073)	(0.00061)	(0.00088)	(0.00014)
2	-1.41E-05	-0.004033	0.003325	-0.000987
	(0.00057)	(0.00060)	(0.00082)	(0.00014)
3	0.000166	-0.002536	0.001024	-0.000521
	(0.00043)	(0.00060)	(0.00076)	(0.00012)
4	-0.000150	-0.001514	-4.08E-05	-0.000310
	(0.00030)	(0.00055)	(0.00063)	(0.00011)
5	-0.000262	-0.000897	-0.000397	-0.000197
	(0.00022)	(0.00047)	(0.00050)	(9.1E-05)
6	-0.000250	-0.000537	-0.000479	-0.000131
	(0.00017)	(0.00040)	(0.00042)	(7.7E-05)
7	-0.000205	-0.000328	-0.000474	-9.06E-05
	(0.00014)	(0.00034)	(0.00036)	(6.5E-05)
8	-0.000164	-0.000203	-0.000443	-6.48E-05
	(0.00012)	(0.00029)	(0.00031)	(5.6E-05)
9	-0.000133	-0.000129	-0.000404	-4.81E-05
	(0.00011)	(0.00025)	(0.00028)	(4.9E-05)
10	-0.000110	-8.40E-05	-0.000364	-3.69E-05
	(9.6E-05)	(0.00021)	(0.00025)	(4.3E-05)
11	-9.28E-05	-5.62E-05	-0.000326	-2.92E-05
	(8.5E-05)	(0.00019)	(0.00023)	(3.8E-05)
12	-7.92E-05	-3.90E-05	-0.000290	-2.38E-05
	(7.6E-05)	(0.00016)	(0.00020)	(3.3E-05)
13	-6.82E-05	-2.81E-05	-0.000256	-1.98E-05
	(6.7E-05)	(0.00014)	(0.00019)	(2.9E-05)
14	-5.91E-05	-2.10E-05	-0.000226	-1.67E-05
	(6.0E-05)	(0.00013)	(0.00017)	(2.6E-05)
15	-5.14E-05	-1.62E-05	-0.000199	-1.43E-05
	(5.4E-05)	(0.00011)	(0.00015)	(2.3E-05)
16	-4.48E-05	-1.30E-05	-0.000175	-1.23E-05
	(4.8E-05)	(9.8E-05)	(0.00014)	(2.1E-05)
17	-3.92E-05	-1.06E-05	-0.000154	-1.06E-05
	(4.3E-05)	(8.6E-05)	(0.00013)	(1.8E-05)
18	-3.43E-05	-8.84E-06	-0.000135	-9.25E-06
	(3.9E-05)	(7.5E-05)	(0.00012)	(1.6E-05)
19	-3.00E-05	-7.49E-06	-0.000119	-8.07E-06
	(3.4E-05)	(6.6E-05)	(0.00010)	(1.4E-05)
20	-2.63E-05	-6.41E-06	-0.000104	-7.05E-06
	(3.1E-05)	(5.8E-05)	(9.5E-05)	(1.3E-05)

Factorization: Structural
Standard Errors: Analytic

Table E5: Impulse responses to a negative foreign demand shock under a flexible exchange rate regime

Period	DLREALGDP_NEW*(ERR2=1)	DLCPI*(ERR2=1)	DLREALER*(ERR2=1)	DLINEQUALITY*(ERR2=1)
1	-0.001272	-0.015518	0.030959	-0.002244
	(0.00817)	(0.00371)	(0.02901)	(0.00052)
2	0.000375	-0.008993	-0.009444	-0.001412
	(0.00717)	(0.00384)	(0.02490)	(0.00055)
3	0.000708	-0.005672	-0.004426	-0.000899
	(0.00417)	(0.00347)	(0.01324)	(0.00051)
4	0.000794	-0.003677	-0.001057	-0.000574
	(0.00255)	(0.00269)	(0.00680)	(0.00040)
5	0.000692	-0.002410	0.000192	-0.000368
	(0.00160)	(0.00197)	(0.00379)	(0.00029)
6	0.000539	-0.001587	0.000525	-0.000237
	(0.00102)	(0.00140)	(0.00229)	(0.00021)
7	0.000395	-0.001046	0.000523	-0.000153
	(0.00066)	(0.00099)	(0.00146)	(0.00015)
8	0.000279	-0.000689	0.000424	-9.91E-05
	(0.00043)	(0.00069)	(0.00095)	(0.00010)
9	0.000193	-0.000454	0.000315	-6.43E-05
	(0.00029)	(0.00048)	(0.00063)	(7.0E-05)
10	0.000131	-0.000298	0.000223	-4.18E-05
	(0.00020)	(0.00034)	(0.00042)	(4.8E-05)
11	8.80E-05	-0.000196	0.000154	-2.73E-05
	(0.00013)	(0.00023)	(0.00028)	(3.3E-05)
12	5.88E-05	-0.000129	0.000105	-1.78E-05
	(9.0E-05)	(0.00016)	(0.00019)	(2.3E-05)
13	3.90E-05	-8.45E-05	7.02E-05	-1.16E-05
	(6.1E-05)	(0.00011)	(0.00013)	(1.6E-05)
14	2.58E-05	-5.54E-05	4.68E-05	-7.58E-06
	(4.2E-05)	(7.7E-05)	(8.6E-05)	(1.1E-05)
15	1.70E-05	-3.63E-05	3.10E-05	-4.96E-06
	(2.8E-05)	(5.3E-05)	(5.8E-05)	(7.5E-06)
16	1.12E-05	-2.38E-05	2.05E-05	-3.24E-06
	(1.9E-05)	(3.6E-05)	(3.9E-05)	(5.1E-06)
17	7.36E-06	-1.56E-05	1.35E-05	-2.12E-06
	(1.3E-05)	(2.5E-05)	(2.6E-05)	(3.5E-06)
18	4.83E-06	-1.02E-05	8.88E-06	-1.39E-06
	(8.9E-06)	(1.7E-05)	(1.8E-05)	(2.4E-06)
19	3.17E-06	-6.68E-06	5.83E-06	-9.08E-07
	(6.0E-06)	(1.2E-05)	(1.2E-05)	(1.7E-06)
20	2.08E-06	-4.38E-06	3.83E-06	-5.94E-07
	(4.1E-06)	(8.0E-06)	(8.1E-06)	(1.1E-06)

Factorization: Structural
Standard Errors: Analytic

Table E6: Impulse responses to a positive world real oil price shock under a fixed exchange rate regime

Period	DLREALGDP_NEW*(ERR2=0)	DLCPI*(ERR2=0)	DLREALER*(ERR2=0)	DLINEQUALITY*(ERR2=0)
1	0.000748	0.007598	-0.003293	0.001464
	(0.00075)	(0.00053)	(0.00092)	(0.00014)
2	0.000619	0.004559	-0.001538	0.000842
	(0.00057)	(0.00058)	(0.00086)	(0.00014)
3	0.000481	0.002844	-0.000844	0.000563
	(0.00044)	(0.00061)	(0.00081)	(0.00012)
4	0.000295	0.001854	-0.000524	0.000393
	(0.00030)	(0.00056)	(0.00067)	(0.00011)
5	0.000164	0.001269	-0.000349	0.000287
	(0.00023)	(0.00049)	(0.00052)	(9.7E-05)
6	8.52E-05	0.000912	-0.000243	0.000219
	(0.00018)	(0.00042)	(0.00042)	(8.5E-05)
7	4.14E-05	0.000689	-0.000176	0.000174
	(0.00015)	(0.00037)	(0.00035)	(7.7E-05)
8	1.76E-05	0.000542	-0.000134	0.000143
	(0.00013)	(0.00033)	(0.00030)	(7.0E-05)
9	4.90E-06	0.000443	-0.000105	0.000121
	(0.00012)	(0.00030)	(0.00027)	(6.5E-05)
10	-1.75E-06	0.000371	-8.60E-05	0.000104
	(0.00011)	(0.00027)	(0.00024)	(6.0E-05)
11	-5.04E-06	0.000317	-7.22E-05	9.00E-05
	(9.4E-05)	(0.00025)	(0.00021)	(5.6E-05)
12	-6.48E-06	0.000275	-6.17E-05	7.89E-05
	(8.3E-05)	(0.00023)	(0.00019)	(5.2E-05)
13	-6.91E-06	0.000241	-5.35E-05	6.95E-05
	(7.4E-05)	(0.00021)	(0.00017)	(4.9E-05)
14	-6.80E-06	0.000212	-4.68E-05	6.15E-05
	(6.6E-05)	(0.00019)	(0.00015)	(4.5E-05)
15	-6.43E-06	0.000187	-4.12E-05	5.46E-05
	(5.9E-05)	(0.00017)	(0.00013)	(4.2E-05)
16	-5.94E-06	0.000166	-3.65E-05	4.85E-05
	(5.3E-05)	(0.00016)	(0.00012)	(3.9E-05)
17	-5.41E-06	0.000147	-3.23E-05	4.31E-05
	(4.7E-05)	(0.00015)	(0.00010)	(3.6E-05)
18	-4.89E-06	0.000131	-2.87E-05	3.83E-05
	(4.2E-05)	(0.00013)	(9.3E-05)	(3.4E-05)
19	-4.39E-06	0.000117	-2.55E-05	3.41E-05
	(3.7E-05)	(0.00012)	(8.3E-05)	(3.1E-05)
20	-3.94E-06	0.000104	-2.27E-05	3.04E-05
	(3.3E-05)	(0.00011)	(7.4E-05)	(2.9E-05)

Factorization: Structural
Standard Errors: Analytic

Table E7: Impulse responses to a positive world real oil price shock under a flexible exchange rate regime

Period	DLREALGDP_NEW*(ERR2=1)	DLCPI*(ERR2=1)	DLREALER*(ERR2=1)	DLINEQUALITY*(ERR2=1)
1	-0.010671	0.018081	0.064139	0.001538
	(0.00813)	(0.00367)	(0.02890)	(0.00052)
2	-0.004267	0.011042	-0.005444	0.001432
	(0.00410)	(0.00269)	(0.01352)	(0.00036)
3	-0.001006	0.006789	-0.006502	0.001273
	(0.00327)	(0.00249)	(0.01077)	(0.00033)
4	0.000708	0.004412	-0.004456	0.001122
	(0.00301)	(0.00245)	(0.00964)	(0.00033)
5	0.001517	0.003050	-0.003135	0.000992
	(0.00283)	(0.00240)	(0.00885)	(0.00032)
6	0.001864	0.002238	-0.002354	0.000885
	(0.00265)	(0.00234)	(0.00819)	(0.00032)
7	0.001974	0.001734	-0.001872	0.000796
	(0.00248)	(0.00224)	(0.00758)	(0.00031)
8	0.001964	0.001407	-0.001557	0.000721
	(0.00231)	(0.00213)	(0.00701)	(0.00030)
9	0.001893	0.001184	-0.001337	0.000656
	(0.00215)	(0.00201)	(0.00648)	(0.00029)
10	0.001792	0.001024	-0.001175	0.000599
	(0.00199)	(0.00189)	(0.00598)	(0.00028)
11	0.001679	0.000903	-0.001049	0.000549
	(0.00185)	(0.00176)	(0.00551)	(0.00027)
12	0.001563	0.000808	-0.000946	0.000504
	(0.00171)	(0.00164)	(0.00507)	(0.00026)
13	0.001449	0.000730	-0.000859	0.000463
	(0.00158)	(0.00153)	(0.00467)	(0.00025)
14	0.001340	0.000663	-0.000784	0.000425
	(0.00146)	(0.00142)	(0.00430)	(0.00024)
15	0.001238	0.000605	-0.000718	0.000391
	(0.00136)	(0.00132)	(0.00396)	(0.00023)
16	0.001142	0.000554	-0.000658	0.000360
	(0.00126)	(0.00122)	(0.00365)	(0.00022)
17	0.001053	0.000509	-0.000605	0.000331
	(0.00116)	(0.00113)	(0.00336)	(0.00021)
18	0.000970	0.000467	-0.000556	0.000305
	(0.00108)	(0.00105)	(0.00309)	(0.00020)
19	0.000894	0.000429	-0.000511	0.000281
	(0.00100)	(0.00097)	(0.00284)	(0.00019)
20	0.000823	0.000395	-0.000470	0.000258
	(0.00093)	(0.00090)	(0.00262)	(0.00018)

Factorization: Structural
Standard Errors: Analytic

Table E8: Impulse responses to a positive foreign real interest rate shock under a fixed exchange rate regime

Period	DLREALGDP_NEW*(ERR2=0)	DLCPI*(ERR2=0)	DLREALER*(ERR2=0)	DLINEQUALITY*(ERR2=0)
1	-0.000550	0.000485	0.003314	-3.28E-05
	(0.00064)	(0.00067)	(0.00087)	(0.00016)
2	-0.003932	0.000802	-0.001715	-0.000561
	(0.00071)	(0.00078)	(0.00105)	(0.00018)
3	-0.000620	0.000346	-0.000300	-3.16E-05
	(0.00048)	(0.00055)	(0.00073)	(0.00012)
4	-0.000211	0.000195	-0.000138	-1.26E-06
	(0.00028)	(0.00037)	(0.00042)	(6.8E-05)
5	-4.95E-05	0.000110	-5.43E-05	9.44E-06
	(0.00018)	(0.00024)	(0.00024)	(4.0E-05)
6	-6.11E-06	6.30E-05	-2.30E-05	8.46E-06
	(0.00010)	(0.00015)	(0.00012)	(2.4E-05)
7	4.57E-06	3.64E-05	-1.00E-05	5.96E-06
	(5.6E-05)	(9.0E-05)	(6.4E-05)	(1.5E-05)
8	5.65E-06	2.11E-05	-4.46E-06	3.83E-06
	(2.9E-05)	(5.4E-05)	(3.3E-05)	(9.3E-06)
9	4.44E-06	1.22E-05	-2.02E-06	2.36E-06
	(1.5E-05)	(3.2E-05)	(1.7E-05)	(5.7E-06)
10	3.05E-06	7.09E-06	-9.32E-07	1.43E-06
	(8.5E-06)	(1.9E-05)	(8.7E-06)	(3.5E-06)
11	1.96E-06	4.11E-06	-4.35E-07	8.49E-07
	(4.9E-06)	(1.1E-05)	(4.7E-06)	(2.1E-06)
12	1.22E-06	2.38E-06	-2.06E-07	5.02E-07
	(3.0E-06)	(6.8E-06)	(2.6E-06)	(1.3E-06)
13	7.45E-07	1.38E-06	-9.85E-08	2.95E-07
	(1.8E-06)	(4.0E-06)	(1.5E-06)	(7.9E-07)
14	4.48E-07	7.98E-07	-4.77E-08	1.72E-07
	(1.1E-06)	(2.4E-06)	(8.5E-07)	(4.7E-07)
15	2.66E-07	4.62E-07	-2.34E-08	1.01E-07
	(7.0E-07)	(1.4E-06)	(5.0E-07)	(2.8E-07)
16	1.57E-07	2.67E-07	-1.17E-08	5.85E-08
	(4.3E-07)	(8.3E-07)	(2.9E-07)	(1.7E-07)
17	9.26E-08	1.55E-07	-5.89E-09	3.40E-08
	(2.6E-07)	(5.0E-07)	(1.7E-07)	(1.0E-07)
18	5.42E-08	8.94E-08	-3.02E-09	1.98E-08
	(1.5E-07)	(2.9E-07)	(1.0E-07)	(6.1E-08)
19	3.17E-08	5.17E-08	-1.57E-09	1.15E-08
	(9.2E-08)	(1.8E-07)	(6.0E-08)	(3.6E-08)
20	1.84E-08	2.99E-08	-8.27E-10	6.64E-09
	(5.5E-08)	(1.0E-07)	(3.5E-08)	(2.2E-08)

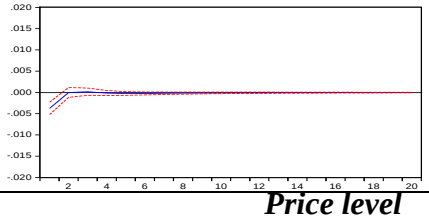
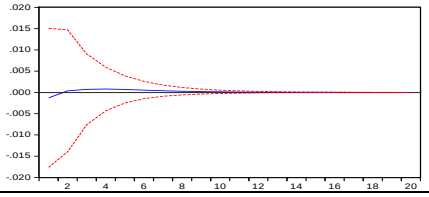
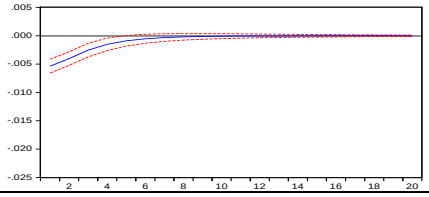
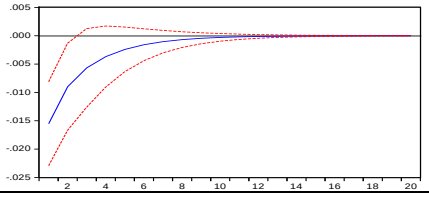
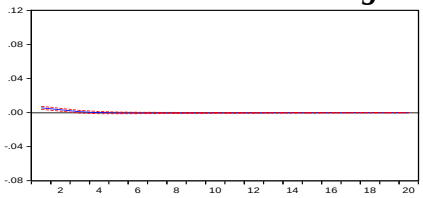
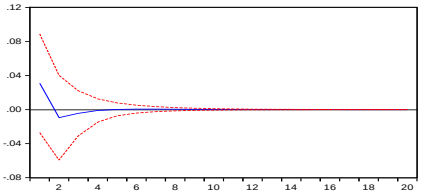
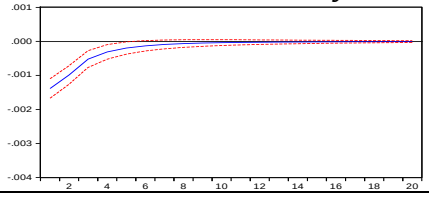
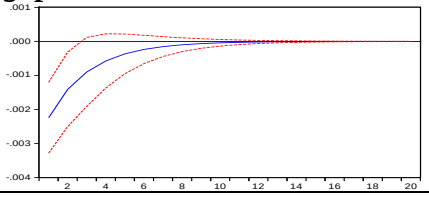
Factorization: Structural
Standard Errors: Analytic

Table E9: Impulse responses to a positive foreign real interest rate shock under a flexible exchange rate regime

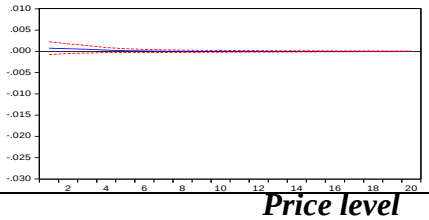
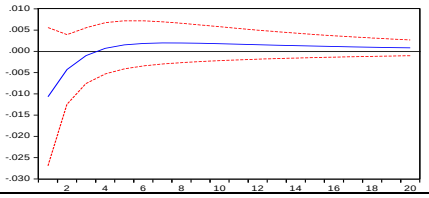
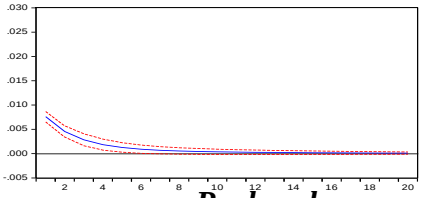
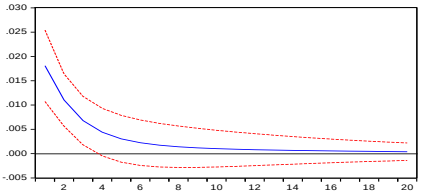
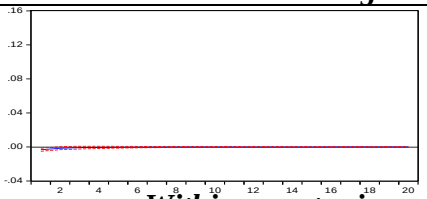
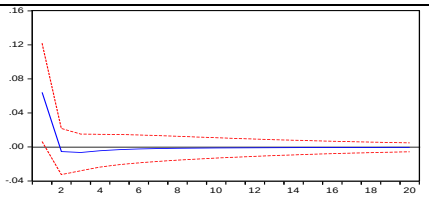
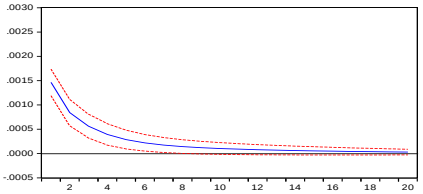
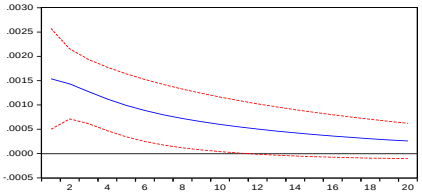
Period	DLREALGDP_NEW*(ERR2=1)	DLCPI*(ERR2=1)	DLREALER*(ERR2=1)	DLINEQUALITY*(ERR2=1)
1	0.022403	-0.014499	0.037023	2.10E-05
	(0.00808)	(0.00365)	(0.02888)	(0.00053)
2	0.002320	0.001403	-0.029518	0.000248
	(0.00841)	(0.00433)	(0.02939)	(0.00062)
3	0.000188	-0.000149	0.001682	0.000102
	(0.00194)	(0.00229)	(0.00464)	(0.00033)
4	0.000178	6.72E-05	7.16E-05	5.89E-05
	(0.00093)	(0.00149)	(0.00184)	(0.00021)
5	5.44E-05	7.34E-05	8.32E-05	3.35E-05
	(0.00054)	(0.00098)	(0.00103)	(0.00013)
6	1.04E-05	6.75E-05	5.14E-07	1.98E-05
	(0.00033)	(0.00065)	(0.00065)	(8.7E-05)
7	-5.68E-06	5.32E-05	-1.95E-05	1.20E-05
	(0.00021)	(0.00043)	(0.00042)	(5.7E-05)
8	-9.63E-06	3.94E-05	-2.28E-05	7.44E-06
	(0.00014)	(0.00029)	(0.00028)	(3.8E-05)
9	-9.15E-06	2.81E-05	-1.97E-05	4.71E-06
	(9.4E-05)	(0.00019)	(0.00018)	(2.5E-05)
10	-7.37E-06	1.96E-05	-1.53E-05	3.02E-06
	(6.2E-05)	(0.00013)	(0.00012)	(1.7E-05)
11	-5.51E-06	1.34E-05	-1.12E-05	1.96E-06
	(4.2E-05)	(8.7E-05)	(8.2E-05)	(1.1E-05)
12	-3.95E-06	9.15E-06	-7.90E-06	1.28E-06
	(2.8E-05)	(5.8E-05)	(5.5E-05)	(7.5E-06)
13	-2.76E-06	6.19E-06	-5.48E-06	8.43E-07
	(1.9E-05)	(3.9E-05)	(3.7E-05)	(5.0E-06)
14	-1.90E-06	4.17E-06	-3.76E-06	5.57E-07
	(1.3E-05)	(2.6E-05)	(2.5E-05)	(3.3E-06)
15	-1.30E-06	2.80E-06	-2.55E-06	3.69E-07
	(8.4E-06)	(1.7E-05)	(1.6E-05)	(2.2E-06)
16	-8.78E-07	1.88E-06	-1.73E-06	2.45E-07
	(5.6E-06)	(1.2E-05)	(1.1E-05)	(1.5E-06)
17	-5.92E-07	1.26E-06	-1.16E-06	1.63E-07
	(3.8E-06)	(7.8E-06)	(7.4E-06)	(1.0E-06)
18	-3.98E-07	8.40E-07	-7.79E-07	1.08E-07
	(2.5E-06)	(5.2E-06)	(4.9E-06)	(6.7E-07)
19	-2.67E-07	5.61E-07	-5.22E-07	7.22E-08
	(1.7E-06)	(3.5E-06)	(3.3E-06)	(4.5E-07)
20	-1.79E-07	3.75E-07	-3.50E-07	4.81E-08
	(1.1E-06)	(2.3E-06)	(2.2E-06)	(3.0E-07)

Factorization: Structural
Standard Errors: Analytic

A negative foreign demand shock

	Fixed ERR	Flexible ERR
	Real GDP	
Impulse response		
	Price level	
Impulse response		
	Real exchange rate	
Impulse response		
	Within-country income gap	
Impulse response		

A positive world real oil price shock

	Fixed ERR	Flexible ERR
	Real GDP	
Impulse response		
	Price level	
Impulse response		
	Real exchange rate	
Impulse response		
	Within-country income gap	
Impulse response		

A positive foreign real interest rate shock

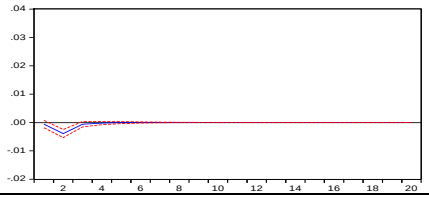
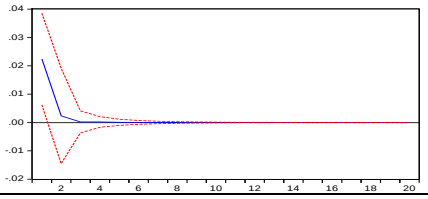
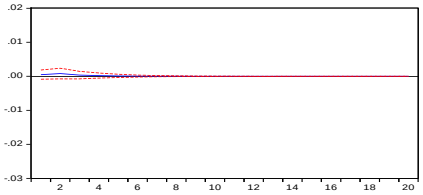
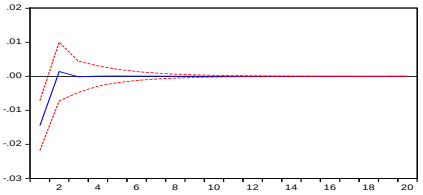
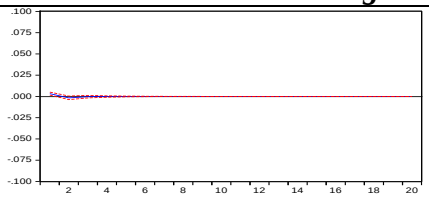
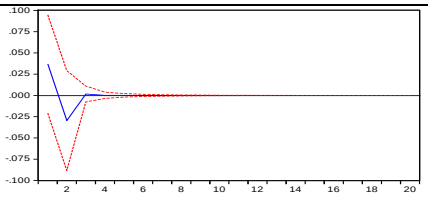
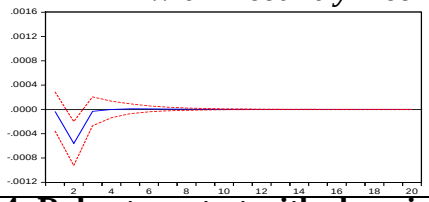
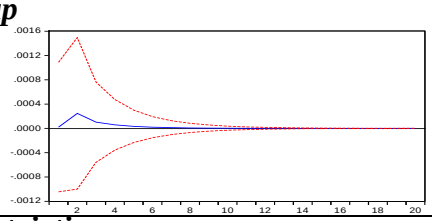
	Fixed ERR	Flexible ERR
	Real GDP	
Impulse response		
	Price level	
Impulse response		
	Real exchange rate	
Impulse response		
	Within-country income gap	
Impulse response		

Figure E4: Robustness test with changing restrictions

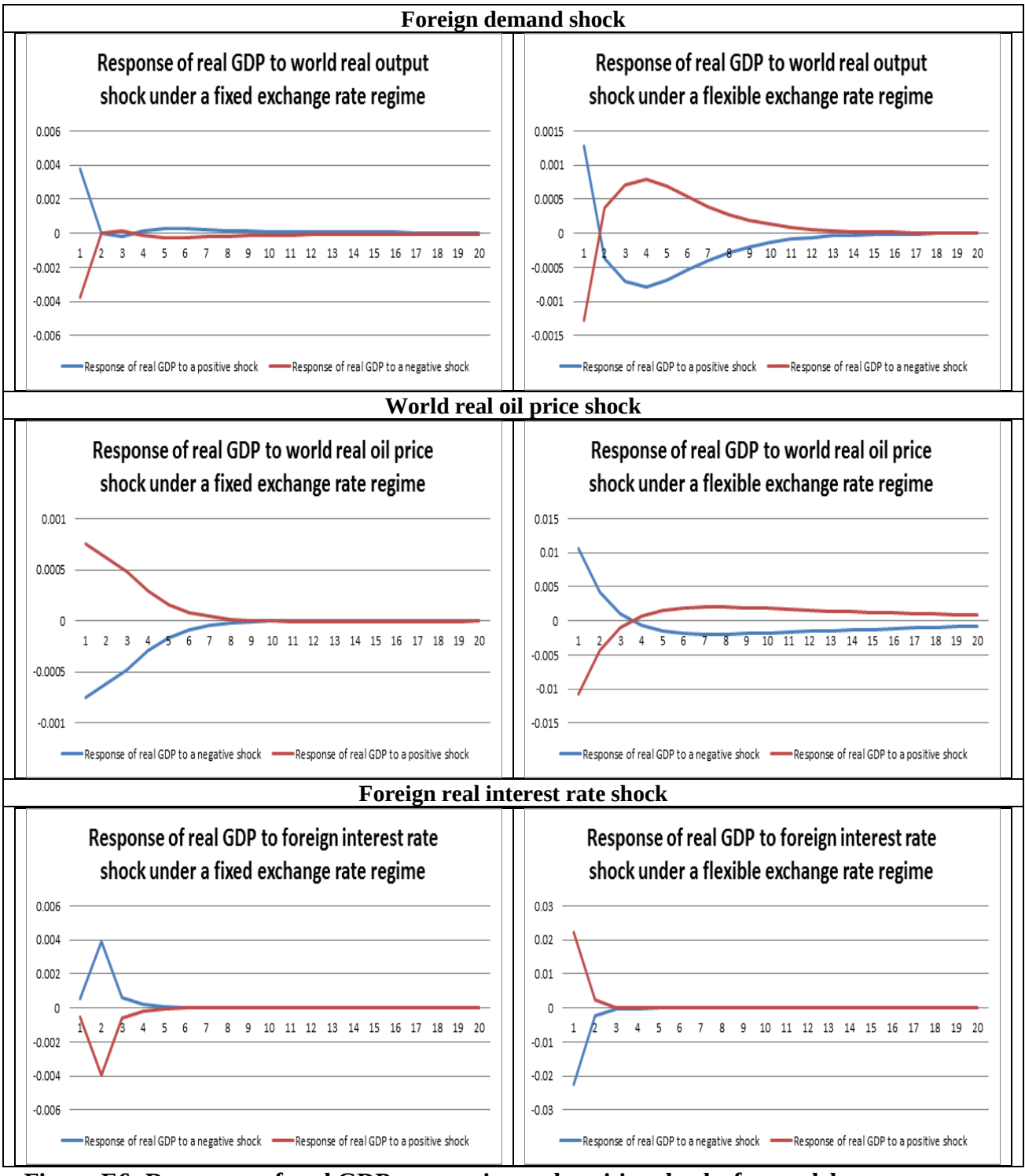


Figure E6: Responses of real GDP to negative and positive shocks for model of within-country income gap

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